

**A REVIEW OF INTERNATIONAL ARID AREAS  
RESEARCH AGENCIES:  
THE IMPLICATIONS FOR INVESTMENT IN THE  
KAROO, KALAHARI AND NAMAQUALAND**



**Doreen Atkinson  
Heartland and Karoo Institute**

**(051) 773 0324  
[karoo@intekom.co.za](mailto:karoo@intekom.co.za)**

**4 March 2008**

**RESEARCH FUNDED BY:  
Eastern Cape Socio-Economic Consultative Council (ECSECC)**

## CONTENTS

<b>Executive Summary .....</b>	<b>3</b>
<b>A. Introduction, rationale and methodology .....</b>	<b>11</b>
<b>B. Australia.....</b>	<b>14</b>
1. The Desert Knowledge CRC .....	14
2. Centre for Arid Zone Research (CAZR) .....	24
<b>C. Africa.....</b>	<b>31</b>
1. The Arid Lands Information Network (East Africa) .....	31
2. Namibia Desert Research Foundation .....	34
3. Morocco .....	34
<b>D. The United States .....</b>	<b>36</b>
1. Office of Arid Lands Studies: University of Arizona.....	36
2. Arizona Rural Policy Institute (ARPI) .....	38
3. University of Arizona Economic & Business Research Centre .....	39
4. The Office of Arid Lands Studies (OALS), University of Arizona .....	41
5. International Sonoran Desert Alliance (ISDA) .....	45
6. International Center for Arid and Semi-arid Land Studies (ICASALS) .....	47
7. ARIDNet .....	48
<b>E. India .....</b>	<b>50</b>
1. Central Arid Zone Research Institute (Jodhpur, India) .....	50
2. Institute for Development Studies, Jaipur (IDSJ).....	51
<b>F. Middle East.....</b>	<b>54</b>
1. Center for Jewish-Arab Economic Development.....	54
2. Centre for Desert Architecture and Planning (CDAUP), Ben Gurion University.....	55
3. Social Studies Unit, Ben Gurion University.....	57
4. Israel Hi-Tech.....	58
<b>G. International agencies.....</b>	<b>61</b>
1. The Food and Agricultural Organisation (FAO) .....	61
2. United Nations.....	62
<b>Conclusion .....</b>	<b>62</b>

## Executive Summary

South African arid areas have not received much attention for the purposes of socio-economic development. The broader issues of regional development in arid areas, small town development, tourism, and niche agricultural products have not been systematically researched in South Africa, although there are some specific studies to draw on.

This paper highlights the intellectual effort which is undertaken in other arid areas of the world, notably in the English-speaking countries (Australia, the USA, Namibia and India). At the same time, deserts and drylands are attracting increasing international attention, from the point of view of conservation as well as development.

The neglect of the Karoo, Kalahari and Namaqualand arises from a variety of causes. Firstly, in terms of the National Spatial Development Perspective (NSDP), the arid areas have not been identified as an area of economic potential. Secondly, the arid areas straddle at least four provinces, which has complicated planning efforts. Thirdly, in all four provinces, intellectual development effort has thus far been directed at the wetter regions, such as the Boland, the ex-homeland areas of the Eastern Cape, and the Bloemfontein and Eastern Free State regions. The fact that the Northern Cape, which contains the lion's share of the arid areas, does not have its own university, means that there is no intellectual driver to pursue topics of specific relevance to arid areas.

In this context, the Eastern Cape Socio-Economic Consultative Council (ECSECC) commissioned a paper to highlight some of the research efforts in arid areas elsewhere in the world. South Africa often faces the potential problem of insularity, because we are poorly networked with potential intellectual peers in other countries. This is due to factors such as distance, linguistic differences, and our *apartheid* history. Nevertheless, in order to “leap-frog” expensive and protracted research and development phases, we need to know what ideas and technologies are available. This may also highlight potential partnerships with university research agencies and government think-tanks.

In this paper, the methodology was solely dependent on Internet searches. This is one of the fastest and most cost-effective methods for “rapid reviews”. The report therefore does not claim to be complete, definitive or even fully up to date. It provides a snap-shot of the research efforts of organisations which have an effective Internet presence. The overview focuses primarily on English-speaking countries.

Furthermore, the report focuses primarily on *novel, cutting-edge business practices and technological innovations, in order to grow the economic base and investment potential of the arid areas*. It is biased towards enhancing new commercial opportunities and capital investment.

The reason for this bias is that the arid areas in South Africa already have a strong entrepreneurship base, located in commercial agriculture, eco-tourism, game farming and accommodation tourism. There are also other niche markets developing, such as space

(telescope) tourism, tourism trails, ostrich products, leather products, indigenous plants, desert crops (such as olives), and carbon sequestration. All these sectors require a great deal of capital investment and technical skill, including an understanding of international markets, environmental conditions, and access to finance. Furthermore, these sectors offer valuable opportunities for employment, employee training, and possibly out-sourcing schemes to smaller entrepreneurs. The task is to build on the existing economic base of the arid areas, and bring it into contact with cutting-edge technologies and practices in the rest of the world, so that our arid areas can become economically competitive.

The underlying logic of development in the arid areas will be “think global, act local”. Thus far, government development efforts in the arid areas have lacked a coherent “*think global*” orientation. Specific entrepreneurs have had to venture into expensive new investments on their own. This report aims at introducing government agencies to the dynamic thinking about arid areas in other countries. This should create awareness of the vast economic potential of the arid areas, and should lead to enterprise support programmes, high-technology production systems, and export promotion efforts, that are uniquely tailored to the assets and resources of the Karoo, Kalahari and Namaqualand.

The following institutions have been included, and in each case, the main themes of their research activity are provided:

### **1. *Australia: Desert Knowledge CRC***

Desert Knowledge CRC focuses on two kinds of products:

- High value per unit cost of transport
- Place-based products, e.g. tourism, and local processing of bush foods.

*Programme: “Livelihoods in Land”:*

1. Community involvement in land conservation (e.g. rangers) in arid areas
2. Indigenous land management in desert areas
3. Promoting sustainable environmental outcomes
4. Promoting ecological education and indigenous ecological knowledge
5. Promoting biodiversity and removing invader species.

*Programme: Bush Products:*

1. Indigenous food production (“bush food”) in the Outback
2. Reconciling pastoralism and biodiversity
3. Tourism: 4x4 drives in the Outback.

*Programme: Thriving desert economies and business: DesBiz*

1. Business-readiness of desert SMMEs
2. Study of multiplier effects
3. Study of aboriginal businesses
4. Indigenous tourism
5. Indigenous plant products

6. Creating business linkages across the desert.

*Programme: Viable desert settlements:*

1. Access to better services in desert communities
2. Reducing costs of service provision
3. Housing types and technologies in deserts

*Programme: Desert services that work:*

1. Demand for government services in arid areas
2. Supply of services
3. Interface between providers and users in desert communities
4. Preferences for specific types of services
5. Different technological options.

**2. *Australia: Centre for Arid Zone Research***

1. Ecology and management of arid rangelands
2. Promote community participation in planning
3. Regional modeling (Outback Atlas)
4. Precision pastoralism
5. Regional ecological conservation
6. Bio-graze: Sustainable grazing systems
7. Understanding small business experiences
8. Rangeways: Community-based regional land-use planning
9. Sustainable use of aboriginal land.

**3. *Africa: Arid Land Information Network:***

1. Information and communications technology to benefit farmers in arid areas
2. On-line pest information
3. Information services for farmers
4. Capacity-building, exchanges, lobbying, networking
5. Newsletter: *The Baobab*.

**4. *Africa: Desert Research Foundation of Namibia (DRFN)***

The Namibia Desert Research Foundation works closely with the Gobabeb Training and Centre, located in Windhoek.

Research topics include:

1. Community decision-making and participatory local poverty assessments
2. Renewable energy systems
3. Networking with ecological experts in arid areas

4. Desertification and community-based responses
5. Desert fauna and flora
6. Rural energy systems, including solar power
7. The ecology of desert dunes
8. Long-term environmental monitoring, as part of the EON (Environmental Observatories Network).

**5. *Africa: Institut Agronomique, Rabat***

1. Biotechnology research
2. Production of essential oils of desert plants, e.g. verbena, thyme, wormwood, rosemary
3. Exports of essential oils.

**6. *Arizona, USA: Office of Arid Lands Studies:***

1. Computerised decision support systems for natural resource management in arid areas
2. Food security assesment and monitoring of crops in arid areas
3. Land use planning in arid areas
4. Water and land conservation, and irrigation management.

**7. *Arizona Rural Policy Institute (ARPI):***

1. Focus on economically depressed regions in arid areas
2. Rural policy analysis
3. Studies of business incentives in desert towns.

**8. *Arizona: Economic and Business Research Centre***

1. Assist business and government with economic planning
2. Research on business promotion strategies
3. Research on the economic impact of the space industry and planetary sciences.

**9. *Arizona: Office of Arid Lands Studies (OALS)***

1. Research on arid plants
2. Remote sensing and geographic information systems
3. Research on economic development
4. Information exchange network
5. Decision support systems
6. Food security assessment and agricultural monitoring
7. Land use planning and management in arid areas
8. *Arid Lands Newsletter*
9. Transboundary water management

10. Climate change
11. Desert architecture
12. Alternative water and sanitation systems

**10. *Arizona: International Sonoran Desert Alliance (ISDA)***

1. Ecological conservation
2. Sustainable housing
3. Economic development in arid areas
4. Computer training to local communities
5. Local arts
6. Business promotion.

**11. *Arizona: International Center for Arid and Semi-arid Land Studies (ICASALS)***

1. Water resources: Hydrology, water quality, water recycling
2. Agriculture: Soil sciences, irrigation, and land
3. Energy sources: Wind power, alternative fuels
4. Environment: Air quality, ecosystems, and weather and climate
5. Land use and planning
6. Geology and mineral resources.

**12. *USA: ARIDNET***

This research network has created the Drylands Development Paradigm (DDP) to promote integrated ecological, economic and social development strategies.

**13. *Central Arid Zone Research Institute, Jodhpur, India***

1. Natural resources surveys, land evaluation, GIS, soil fertility, desertification
2. Indigenous and medicinal plants
3. Biodiversity conservation
4. Agriculture, agroforestry, horticulture
5. Management of forage land
6. Watershed management, underground water, rehabilitation of waste land
7. Alternative energy, solar power
8. Women in agriculture

**14. *Institute for Development Studies (IDSJ), Jaipur, India***

1. Economic policies and strategies: Agriculture, food security

2. Livestock
3. Urban informal sector
4. Urban poverty
5. Rural finance and credit
6. Water management
7. Biodiversity in arid areas.

**15. *Centre for Jewish-Arab Economic Development***

1. Promoting Arab businesses, and creating linkages with Jewish businesses
2. Empowering women
3. Promoting desert tourism enterprises
4. Promoting indigenous crafts.

**16. *Centre for Desert Architecture and Planning, Ben-Gurion Desert University***

1. Desert habitation, construction technology
2. Urban form
3. Regional development
4. Reducing energy requirements in desert buildings
5. Alternative energy

**17. *Social Studies Unit, Ben-Gurion Desert University***

1. Bedouin culture and modernization
2. Climate change and water resources
3. Co-operative agricultural systems
4. Pastoralism and rural villages
5. Comparative studies – Kalahari (Botswana), Nepal, India, Zambia
6. New immigrants to Israeli desert areas
7. The political economy of agriculture
8. The future of kibbutzes.

**18. *Israel Hi-Tech***

1. Using brackish water for irrigation – melons, tomatoes, flowers, olives, pears, grapes
2. Solar energy
3. Carbon sequestration in the desert
4. Bedouin health, education and agriculture.

### **19. *Food and Agriculture Organisation (FAO)***

1. Community management of natural resources, such as land and catchment systems
2. Market dynamics in the drylands
3. Raising production for export
4. Problems of desertification
5. Soil management
6. Afforestation
7. Pastoral nomad communities.

### **20. *United Nations***

1. Desertification
2. local economic development,
3. gender issues,
4. poverty eradication,
5. relief delivery and food security
6. climate change research
7. natural resources management
8. ecology, zoology and botany of arid lands.

## **Conclusion**

South Africa has a great deal to learn from research conducted elsewhere in the world, particularly as regards economic investment in desert regions. In certain ways, our Karoo, Kalahari and Namaqualand areas are already well developed, particularly in terms of commercial agriculture and urban infrastructure. But there are new and pressing issues on the horizon, particularly with regards to climate change, the need for sustainable desert agriculture, the growth in international tourism, and the need to grow the enterprise base of the local economy, with particular emphasis on the involvement of black and low-income entrepreneurs.

The overview presented in this report has highlighted the following themes, which can guide South African Research and Development in arid areas:

1. Improving government service delivery in arid areas, particularly with regards to appropriate technology (housing, energy, water and sanitation)
2. Creating partnerships between established (often white-owned) and emerging (often black-owned) businesses
3. Promoting high-value desert products (particularly if they are low-cost, in terms of transport)
4. Promoting place-bound products (such as tourism sites)

5. Identifying desert cultural resources (e.g. indigenous knowledge and art)
6. Productive use of land by non-western communities, and by indigenous farmers, including sustainable grazing systems – this can have a major significance for commonage land in Namaqualand, the Kalahari and in peri-urban areas in the Karoo
7. Promoting community rangers on game farms and game reserves in the arid areas
8. Promoting environmental education for school learners in the arid areas
9. Production of indigenous crops and herbs
10. Improving local pastoral practices, particularly with regards to sheep and goats
11. Investigating, professionalising and promoting off-road tourism (e.g. 4x4 tourism)
12. Promoting business networking in the arid areas, including the creation of partnerships and consortia to bid for bigger projects
13. Creating realistic opportunities for the involvement of local black and coloured businesses in tourism enterprises
14. GIS and spatial planning systems that show business, agriculture and tourism projects, together with underground and surface water resources and transport systems
15. Assisting networking amongst emergent farmers in the Karoo, Kalahari and Namaqualand, and the introduction of internet-based information systems
16. Business incentives offered by municipalities, to attract investment
17. Business support systems for start-up businesses
18. Promote the Karoo space projects (telescopes) as a tourism destination, and maximise the multiplier effects of tourism activities in these areas
19. Promoting cross-border planning systems, whether across local, district, provincial or national boundaries
20. Researching population dynamics, poverty, and migration patterns.
21. Promoting cutting-edge, high-technology projects in arid areas, such as solar and wind energy and the effective use of water resources
22. Analyse the interaction between human and ecological systems (such as watersheds, ecologically sensitive areas, and grazing land).

These initiatives will require the creation of a strategic “Greater Karoo” economic agency, to identify economic options, lobby funders and decision-makers, and assist local stakeholders to network and to refine their business ideas. Such an agency should build up a repository of arid areas information and issue a newsletter, circulated to a data-base of entrepreneurs in the arid areas.

## A. Introduction, rationale and methodology

South African arid areas have not received much attention for the purposes of socio-economic development.

A significant amount of effort has gone into researching and exploring ecological issues, particularly under the auspices of STEP (Sub-Tropical Thicket Ecosystems Programme), SKEP (Succulent Karoo Ecosystem Programme) and AZEF (the Arid Zone Ecological Forum). These programmes are well networked amongst government, universities, NGOs and private research agencies, and have produced a large number of post-graduate students and research papers. Significantly, these programmes are increasingly involving local communities in undertaking research and designing small-scale local development projects. The experience of community-based Rooibos producers in Namaqualand is a case in point.

However, the broader issues of regional development in arid areas, small town development, tourism, and niche agricultural products have not been systematically researched in South Africa, although there are some specific studies to draw on.

This paper highlights the intellectual effort which is undertaken in other arid areas of the world, notably in the English-speaking countries (Australia, the USA, Namibia and India). At the same time, deserts and drylands are attracting increasing international attention, from the point of view of conservation as well as development. The first goal of the International Year of Deserts and Drylands, or IYDD (2006) was to celebrate deserts' unique biological and cultural diversity, while raising awareness of the need to protect these unique resources.<sup>1</sup> The IYDD's aims were to celebrate deserts' unique biological and cultural diversity, while raising awareness of the need to protect these unique resources; and to highlight the growing threat of desertification to humans, especially in light of desertification's implications for achievement of the Millennium Development Goals.<sup>2</sup>

In June 2006, UNESCO organized an international scientific conference, "The Future of Drylands," in Tunis. Conference participants adopted a "Declaration on Research Priorities to Promote Sustainable Development in Drylands," which "calls upon governments to use sound scientific knowledge to formulate and implement policies, laws, regulations and action programmes vis-à-vis environmental issues" (UNESCO 2006, 2).<sup>3</sup>

---

<sup>1</sup> <http://ag.arizona.edu/OALS/ALN/ALNHome.html>.

<sup>2</sup> <http://ag.arizona.edu/OALS/ALN/aln59/ednote59.html>

<sup>3</sup> UNESCO. 2006. International Scientific Conference "The Future of Drylands", Tunis (Tunisia), 19 to 21 June 2006: Declaration on research priorities to promote sustainable development in drylands, or the "Tunis Declaration". Online: [http://www.unesco.org/mab/ecosyst/drylands/docs/E\\_Tunisdeclaration.pdf](http://www.unesco.org/mab/ecosyst/drylands/docs/E_Tunisdeclaration.pdf).

In South Africa, the arid south-western part of the country has received little developmental attention. This neglect of the Karoo, Kalahari and Namaqualand arises from a variety of causes. Firstly, in terms of the National Spatial Development Perspective (NSDP), the arid areas have not been identified as an area of economic potential. (Beaufort West is a rural development node, but it was largely selected because of its preponderance of poverty in the Western Cape).

Secondly, the arid areas straddle at least four provinces<sup>4</sup>, which has complicated planning efforts. The Provincial Growth and Development Strategies have not been proactive in seeking cross-border development options. This means that it has been difficult to detect possible synergies amongst the four provinces (or amongst the 11 District Municipalities<sup>5</sup> that contain components of the arid areas).

Thirdly, in all four provinces, intellectual development effort has thus far been directed at the wetter regions, such as the Boland, the ex-homeland areas of the Eastern Cape, and the Bloemfontein and Eastern Free State regions. The fact that the Northern Cape, which contains the lion's share of the arid areas, does not have its own university<sup>6</sup>, means that there is no intellectual driver to pursue topics of specific relevance to arid areas. In this context, the Eastern Cape Socio-Economic Consultative Council (ECSECC) commissioned a paper to highlight some of the research efforts in arid areas elsewhere in the world. South Africa often faces the potential problem of insularity, because we are poorly networked with potential intellectual peers in other countries. This is due to factors such as distance, linguistic differences, and our *apartheid* history. Nevertheless, in order to "leap-frog" expensive and protracted research and development phases, we need to know what ideas and technologies are available. This may also highlight potential partnerships with university research agencies and government think-tanks.

In this paper, the methodology was solely dependent on Internet searches. This is one of the fastest and most cost-effective methods for "rapid reviews". The report therefore does not claim to be complete, definitive or even fully up to date. It provides a snap-shot of the research efforts of organisations which have an effective Internet presence.

The report also has other limitations. It does not include material from French- or Spanish-speaking arid countries, and therefore has a bias towards English-speaking countries (i.e. ex-colonies of the British empire).

Furthermore, the report focuses primarily on *novel, cutting-edge business practices and technological innovations, in order to grow the economic base and investment potential of the arid areas*. It is biased towards enhancing new commercial opportunities and capital investment. The report has deliberately excluded a range of issues, in order to

---

<sup>4</sup> Western Cape Eastern Cape, Northern Cape and Free State.

<sup>5</sup> Western Cape: Central Karoo DM, Eden DM, West Coast DM; Eastern Cape: Cacadu DM, Chris Hani DM, Ukhahlamba DM; Northern Cape: Pixley ka Seme DM, Namaqua DM, Siyanda DM and Kgalagadi DM. Free State: Xhariep DM.

<sup>6</sup> With the exception of a new tertiary teaching facility, the National Institute of Higher Education (NIHE), in Kimberley. The Institute has no research capacity.

keep the subject-matter manageable. Most significantly, it does NOT focus on: desertification, water conservation, general agriculture, biodiversity, poverty and peasant-based livelihoods. There are significant cases where poor people are involved in arid projects (such as the aboriginal communities in Australia, the Bedouin in Israel, small-scale farmers in Kenya, or rural communities in India), but the hallmark of these projects is that new and innovative technologies and practices are promoted. Such cases are also included in this report.

The reason for this bias is that the arid areas in South Africa already have a strong entrepreneurship base, located in commercial agriculture, eco-tourism, game farming and accommodation tourism. There are also other niche markets developing, such as space (telescope) tourism, tourism trails, ostrich products, leather products, indigenous plants, desert crops (such as olives), and carbon sequestration. All these sectors require a great deal of capital investment and technical skill, including an understanding of international markets, environmental conditions, and access to finance. Furthermore, these sectors offer valuable opportunities for employment, employee training, and possibly out-sourcing schemes to smaller entrepreneurs. The task is to build on the existing economic base of the arid areas, and bring it into contact with cutting-edge technologies and practices in the rest of the world, so that our arid areas can become economically competitive.

The underlying logic of development in the arid areas will be “think global, act local”. Already, the South African government promotes “*act local*” business support, such as the SEDA (Small Enterprise Development Agency) system, the Skills Development Fund, the Department of Labour’s training system, the “Red Door” and CASIDRA programmes in the Western Cape, the Thina Sinako Programme in the Eastern Cape, the various provincial development corporations, and even the Lotto grant system.

Thus far, government development efforts in the arid areas have lacked a coherent “*think global*” orientation. Specific entrepreneurs have had to venture into expensive new investments on their own. This report aims at introducing government agencies to the dynamic thinking about arid areas in other countries. This should create awareness of the vast economic potential of the arid areas, and should lead to enterprise support programmes, high-technology production systems, and export promotion efforts, that are uniquely tailored to the assets and resources of the Karoo, Kalahari and Namaqualand.

The report is structured along geographic and institutional lines. Each section focuses on a different continent, and outlines specific institutions and their research programmes. The following countries are included in the survey: Australia, Africa, the United States, India, the Middle East, and international development agencies. The summaries are often very short, compared to the vast material that is available. Consequently, web-site addresses are provided in footnotes for easy reference.

## **B. Australia**

### **1. The Desert Knowledge CRC**

The centre-piece of Australian arid areas networking and lobbying is Desert Knowledge Australia (DKA), an agency that promotes “living well in the desert”. It also aims at “Linking desert Australians, finding desert solutions”.

DKA is assisted by the Desert Knowledge CRC (Co-operative Research Centre), a “national research network linking indigenous and local knowledge with science and education to improve local livelihoods”.

The Desert Knowledge CRC is a research and brokerage institution that links researchers with 27 partners.<sup>7</sup> The Desert Knowledge CRC focuses these research efforts on creating useful outcomes with commercial application for desert people, communities and our partners. These partners provide in-kind and cash support to the Desert Knowledge CRC.

The Desert Knowledge CRC exists to:

- Provide *sustainable livelihoods* for desert people that are based on natural resource and service enterprise opportunities that are environmentally and socially appropriate
- Encourage *sustainable remote desert settlements* that support the presence of desert people, particularly remote *Aboriginal communities*, as a result of improved and efficient governance and access to services
- Foster thriving *desert regional economies* that are based on desert competitive advantages, bringing together Aboriginal and non-Aboriginal communities, government and industry and
- Apply social science insights into *governance, human capacity and the design of appropriate institutions* to all these outcomes.

DKA aims at increasing local economic resilience: “Desert Australia needs to grow to encourage self-reliant regional economic development and reduce its long-term call on the public purse. It needs to attract and retain people who can sustain the region’s services and create wealth. It competes with growing coastal regions for resources and the attention of politicians and bureaucrats. Sustainable health and education services in desert Australia, for Indigenous and non-Indigenous people alike, depend on wealth creation and its equitable distribution across the population.”<sup>8</sup>

Their aspirations will be compatible with national priorities if the benefit of people living in desert Australia exceeds the costs, especially if the net benefits steadily increase. The definition of costs and benefits requires close attention, but the Desert Knowledge

---

<sup>7</sup> <http://www.desertknowledgecrc.com.au/>.

<sup>8</sup> <http://www.desertknowledgecrc.com.au/research/overview.html>

movement supports this reality. This creates clear strategic research requirements for DK-CRC.

The Desert Knowledge CRC poses an important question: Should we pursue knowledge related to a predominantly *welfare-driven* economy, or should we rather develop ideas that might flow from transforming it into an environment with greater *private investment and individual enterprise*, albeit one based on natural and cultural values?”

The CRC claims that “Indigenous and non-Indigenous people in desert Australia seek to build livelihoods in places that they can afford and which provide them with access to a desirable range of services. They are looking for networks of settlements, regional services and small businesses across desert Australia that provide security.”<sup>9</sup> The CRC therefore opts for a focus on individual enterprise, but within a context which is sensitive to social customs and values.

Four key outcomes can be distinguished in the CRC literature.

### **Outcome 1: Sustainable livelihoods for desert people**

Long distances to market and high transport costs dictate the production of two kinds of goods and services: those that deliver a high return per unit cost of transport (high value) and those that can only be obtained from desert Australia (place-based).<sup>10</sup>

For example, art works and knowledge about deserts are examples of *high value products* that are cheap to transport compared to their value. Tourist sites, living Aboriginal culture and wide open spaces are examples of *place-based*

*products*. Even place-based products must be delivered at a price which matches their perceived value – for example, tourists must feel their experience warrants the cost of flying in. Such products should also be strongly value-adding to retain economic benefits locally, as with bush foods which are processed locally, and must be delivered as cost-effectively as possible. The local costs of any desert product are relatively high because the cost of labour and other inputs are more expensive in remote areas.

***Desert Knowledge CRC focuses on two kinds of products:***

- (1) High value per unit cost of transport
- (2) Place-based products, e.g. tourism, and local processing of bush foods.

The CRC’s livelihoods focus entails the following:

- The most compelling competitive advantages of desert regions are to be found in their *place-based natural and cultural resources*, and knowledge about these.
- We must understand how to *manage these resources* most efficiently and effectively while at the same time *creating new and diversified livelihood*

<sup>9</sup> <http://www.desertknowledgecrc.com.au/research/overview.html>

<sup>10</sup> <http://www.desertknowledgecrc.com.au/research/overview.html>

*opportunities* based on them for Indigenous and non-Indigenous people in remote settlements.

- We must explore how to *add value* to major business opportunities by increasing the value, and therefore long-term profitability, of their products.
- We must support the *wide range of smaller desert business opportunities*, which individually do not warrant targeted research, to deal with these issues in a more generic way.

This leads to three Core Projects (CPs):

(1) *Livelihoods in Land*<sup>11</sup>

This project promotes livelihoods from desert resources. It aims to understand how to value and capture the value of managing *public goods*, such as natural and cultural heritage, including the appropriate institutional arrangements. This project maximises national benefits by targeting better investment in remote areas.

Desert people are regarded as an asset, because they provide a service to government and society when they manage the flow of natural and cultural services. This generates livelihood opportunities since it requires work to be done by people. Critical questions for the future of desert Australia are the extent to which this required work is recognised, resourced and available to desert people.

The Livelihoods in Land<sup>TM</sup> project will model the relative benefit from investment in management of natural and cultural resources by alternative pathways. Existing models are sectorally based, but a more holistic assessment is required to understand livelihood opportunities. It should also include non-market outcomes, such as those that underpin production in industries such as tourism and art.

The project shows stakeholders in policy arenas the value to Australia of non-market outcomes from remote living. It also develops understanding of institutions for building regional economic development from the value of desert resources. Livelihoods in Land<sup>TM</sup> research also benefits local stakeholders by supporting development of livelihoods, and generating new knowledge through research collaborations between scientists,

***CRC: Livelihoods in Land:***

- Community involvement in land conservation (e.g. rangers)
- Indigenous land management
- Promoting sustainable environmental outcomes
- Promoting ecological education and indigenous ecological knowledge
- Promoting biodiversity and removing invader species.

<sup>11</sup> <http://www.desertknowledgecrc.com.au/research/livelihoods.html>.

Aboriginal and local knowledge holders, research training and capacity building.

Research activities in the project include:

- Joint supply of environmental and health services to remote Australia
- Participatory modelling of livelihoods in land
- Understanding conservation outcomes
- Funding Aboriginal land management in central Australia
- Livelihoods in water management
- Community ranger program
- Bush schools.

The project will produce design principles for systems that will deliver livelihoods (health, wellbeing, income) through natural and cultural resource management, and an investment model to show the value to Australia of such systems, compared with alternative ways of managing natural and cultural resources.

Thus far, research has been done on promoting environmental conservation for aboriginal Australians, as a complementary activity to improving people's health (e.g. promoting exercise and reducing drug use). Furthermore, studies have been done on biodiversity, fire, wind erosion, and the eradication of "buffel grass" (a botanical invader).

## (2) *Bush Products*

Key industry opportunities in remote areas aims to lift remote area industries, in particular bush products, 4WD self-drive remote tourism and "smarter pastoralism".

This involves three specific projects:

### (a) *Indigenous food production ("Bush food"):*

Indigenous products are a young industry, with several hurdles to overcome before it can reach its full potential. Constraints lie in highly variable production, limited markets and social factors (e.g. skills transfer). This research takes a "whole of supply-chain" approach to assist aboriginal groups to develop the native foods industry, the value of the produce, and the benefits their communities can derive from it.<sup>12</sup>

#### **CRC: Bush Products:**

1. Indigenous food production ("bush food")
2. Reconciling pastoralism and biodiversity
3. Tourism: 4x4 drives

<sup>12</sup> Jenny Cleary, "Bush Food Systems", at <http://www.desertknowledgecrc.com.au/research/livelihoods.html>.

- Indigenous Livelihoods and the benefits of the indigenous food industry, including improved incomes, new job prospects and new skills
- Healthier people, through access to healthy, locally produced food
- Promoting indigenous knowledge and skills
- Diversifying bush product livelihoods – examination of the possible livelihoods from art and craft products, waxes and resins
- Industry opportunities for bush foods harvesters and wholesalers
- Participatory domestication of bush, for sale to the horticulture and retail nursery trade
- Market research and industry development, including branding and policy-related matters – examining ways to strengthen the marketability of desert products through branding, government policies, attracting investors, and assisting in the creation of Indigenous businesses.

*(b) Promoting biodiversity and pastoralism*

This project focuses on the ways in which pastoralism (livestock farming) can be reconciled with biodiversity maintenance.<sup>13</sup> The project focuses on creating:

- Guides on how to measure biodiversity and natural resource condition
- Biocredits for measuring consistent performance at delivering sustainable outcomes
- Standards for ranking the performance and allocating biocredits
- A rewards trading scheme linked to property productivity.

The 21st Century Pastoralism™ Project aims to create a desert pastoral research collaboration that spans desert regions, and the variety of scientific disciplines relevant to extensive pastoral production systems.<sup>14</sup>

Two strategic research areas have emerged:<sup>15</sup>

1. Utilising technology, primarily remote management and telemetry, to improve animal and herd management decisions
2. Engaging Aboriginal pastoralists: Evaluating indigenous pastoral practices to improve economic, social and environmental impacts

*(c) 4x4 Drives: On Track™*

---

<sup>13</sup> Anita Smyth and John Chappel, “Rewards for biodiversity”, at <http://www.desertknowledgecrc.com.au/research/overview.html>.

<sup>14</sup> <http://www.desertknowledgecrc.com.au/research/pastoralism.html>.

<sup>15</sup> “21<sup>st</sup> Century Pastoralism™”, compiled by Andrew Bubb, at <http://www.desertknowledgecrc.com.au/research/pastoralism.html>.

Demand for 'off-road' experiences in desert Australia is growing. But very little is known about how desert people can translate the potential of this market into sustainable livelihoods. Desert people want to know how to balance the benefits and consequences of increasing visitor numbers to remote, and to culturally and environmentally sensitive places.<sup>16</sup>

The first stage of the project will develop an understanding of 4WD tourism markets, their motivations, trip preferences and behaviour. A geographic information system called Visualising Relatively Unpredictable Movement (VRUM™) is being developed to map out the flows of 4WD travellers across desert Australia and describe the interactions between visitors, settlements, infrastructure and natural and cultural resources. The framework will be immediately useful for identifying where such interactions may occur and facilitating community, business and government engagement in managed 4WD tourism development. The framework will lead to the development of knowledge products to address specific management issues.

These may include product development guides for communities, 'safe travel' protocols for visitors and settlements, impact assessment and forecasting models, and education and training resources which will be addressed in stage 2.

There are many issues affecting the development of 4WD tourism: safety and responsible driving practices, land tenure access, economic opportunities for Aboriginal communities, changes in travel technology, changes in holiday travel patterns and so on.

On Track incorporates seven specific areas of investigation: some of which are well underway:

- Information gathering – Collate relevant data sets to describe desert 4WD systems and make the usefulness of these known to researchers through a data dictionary.
- Information Representation – Develop techniques for presenting data sources including a geographic information system and visitor flows model.
- Innovation constraints and opportunities – Describe opportunities that exist for desert communities to develop viable livelihoods around 4WD tourism.
- Market profiling of the different desert 4WD tourism markets to assist marketing and management.
- 'The ideal 4WD experience' – Analyse travel diaries, web logs (blogs), popular literature and other qualitative sources to identify the key elements of 4WD tourism experiences.
- Responsible travel practices – Research issues relating to safety, legal compliance, and environmentally and culturally appropriate behavior in desert 4WD systems.

Partners include universities, provincial governments, 4x4 associations, indigenous groups, and tourism agencies.

---

<sup>16</sup> <http://www.desertknowledgecrc.com.au/research/4wdtourism.html>.

## B. Outcome 2: Thriving desert regional economies

Since Desert Australia is vast and sparsely populated, there is low critical mass in business activity and in local markets. There is a Catch-22: individual small businesses cannot reach out to an external market. More than elsewhere, private investment needs to be networked, and public investment needs to facilitate this. This requires an understanding of *future population movements, economic flows, or resource and cultural limitations* for different regions. This understanding is critical to *public investments* which create thriving regional economies that are much stronger than the sum of their dispersed and precarious parts.

This informs a core project which aims mainly to understand how individual regions function as a *network of settlements and businesses with movement of people and resources* among them. It also seeks

### ***Thriving desert economies and business: DesBiz***

1. Business-readiness of desert SMMEs
2. Study of multiplier effects
3. Study of aboriginal businesses
4. Indigenous tourism
5. Indigenous plant products
6. Creating business linkages across the desert.

to establish the direction and causes of population changes and other factors for the whole of desert Australia (see diagram for these different scales). Desert regions need to be analysed as integrated systems, to facilitate regional economic development.

The project called Des Biz™ focuses on desert entrepreneurs. This project aims to understand and overcome the constraints on remote businesses and to make small businesses more resilient, profitable and able to engage with the wider economy, with an emphasis on Indigenous involvement.<sup>17</sup> The Desert Biz™ project seeks to understand how small businesses and small business networks can more effectively deliver livelihoods for desert people based on natural and cultural resources and on service delivery, in ways that are environmentally sound and socially appropriate.

The research focuses on the following areas:

1. Strong Desert Business: An audit of the work and business situation in Desert Australia to determine *business-readiness* and determine the needs of Desert Australia in relation to small to medium enterprise (SME) development<sup>18</sup>
2. An analysis of the impacts of businesses on the community and the local economy to determine *multiplier effects* of businesses and identify high impact areas for investment

<sup>17</sup> <http://www.desertknowledgecra.com.au/research/desertbiz.html>.

<sup>18</sup> Craig James, "Strong Desert Business",  
<http://www.desertknowledgecra.com.au/research/desertbiz.html>.

3. A study of the factors determining the success or failure of *aboriginal business*, in particular, balancing commercial and social values<sup>19</sup>
4. *Indigenous tourism research*<sup>20</sup>, including niche markets and products, raising awareness of the availability of indigenous tourism products, branding, and the success of indigenous businesses.
5. *Plants for People*: Collect information about aboriginal knowledge of indigenous plants of medicinal, food, commercial or cultural value, and to develop practical ways for desert communities to cultivate these plants and build successful businesses<sup>21</sup>
6. *Linking businesses across the desert*: This project promotes networking among more than 300 businesses through out the desert areas, in four industries (tourism, mining, indigenous products, and sustainable construction. This assists businesses with regards to marketing and tendering.<sup>22</sup>

The project will identify critical success factors and business models that are more appropriate and culturally sensitive to Aboriginal entrepreneurs and suited to Desert Australia. The targeted outcomes are new micro and small businesses initiated based on new models of investment and understanding of the key success factors in encouraging entrepreneurial activity in Desert regions of Australia

### **Outcome 3: Viable remote desert settlements, particularly remote Indigenous communities**

Services in desert Australia are fragmented across state borders and sectors. This *increases the cost of living in the desert* even further. Because service delivery to desert Australia is a low priority for most service delivery agencies, they impose models that suit areas with denser population. As a result services are driven by supply rather than demand. For example, housing must meet east coast standards rather than local community needs, education prepares for life in cities, not remote communities. Although there are exceptions, this ‘deficit’ approach to ‘service need’ is pervasive. Instead of people living in remote areas being able to balance lifestyle priorities and demand for services openly, they must accept expensive, yet often ineffective service delivery.<sup>23</sup>

---

<sup>19</sup> Louise Moylan, “‘Family’ and ‘culture’ spells ‘Business success’”,  
<http://www.desertknowledgecrc.com.au/research/desertbiz.html>.

<sup>20</sup> Joc Schmiechen, “Indigenous Tourism Research Agenda: Key directions for the future, 2005-8”,  
<http://www.desertknowledgecrc.com.au/publications/downloads/NTTC-STCRC-DKCRC-TSCRC-CDU-Indigenous-Tourism-Research-Agenda-Jan-2006.pdf>.

<sup>21</sup> <http://www.desertknowledgecrc.com.au/research/pastoralism.html>.

<sup>22</sup> “Linked Business Networks Project”,  
<http://www.desertknowledgecrc.com.au/publications/downloads/Linked-Business-Networks-Proj.pdf>

<sup>23</sup> <http://www.desertknowledgecrc.com.au/research/overview.html>.

One major consequence is intensifying political debate about the costs and consequences of services in remote settlements, aimed mainly at Indigenous communities, but actually just as applicable to mining, tourism and pastoral remote settlements, as well as larger services centres. This debate lacks balanced data on the *costs and benefits of these settlements*. It also ignores significant *technological opportunities* that could promote services in desert settlements, lowering costs, increasing benefits, reducing public expense and creating additional desert livelihood opportunities.

These issues inform Desert Knowledge CRC's settlements work:<sup>24</sup>

- Understanding what factors determine the *viability*, vitality and resilience of remote settlements of differing size, remoteness and social characteristics.
- Finding out which forms of *governance and institutional structure* most clearly express demand in these settlements, thereby reducing demand for inappropriate services
- Exploring the *technical options* make those services for which there is demand most cost-effective
- Identifying *business solutions* that help communities to use these services and that may in themselves create additional jobs in communities.

***CRC: Viable desert settlements:***

- Access to better services
- Reducing costs
- Housing types and technologies

This leads to a further two Core Projects, one to understand what makes settlements viable, and the other to seek technical and social solutions for better service delivery in the future. These projects will consider settlements from very remote and small to larger towns, but most attention will be paid to Indigenous settlements. This leads to two further Core Projects:

(1) *What makes desert settlements viable?* This project aims to help communities to understand what would make their settlement more viable and to inform the debate about the viability of remote settlements. This includes the institutional and governance frameworks that most clearly express demand for services.

(2) *Improving access to better services and reducing public costs:* This includes non-welfare approaches to facilitating access to services, reducing costs and increasing efficiencies, models for business and institutional structures, and for policy and investment responses.

The project entitled *Lifecycle Models for Sustainable Investment in Desert Communities* promotes innovative strategies, with particular focus on indigenous settlements. The research identifies and models housing systems, technology choices, materials

---

<sup>24</sup> <http://www.desertknowledgecrc.com.au/research/settlements.html>.

performance, knowledge gaps, technical education, economic capacities, and local user experiences in community living.<sup>25</sup>

#### **Outcome 4: Desert services that work**

This project will promote demand-responsive services to Desert Settlements.<sup>26</sup> The Project will analyse the service delivery system, identify critical issues and strategies that provide leverage for change, design technology-based models and service delivery models with the potential to improve the system, and then trial, monitor and evaluate their success. By tackling problems at the interface between demand and supply of services to desert settlements, the Project will seek to improve consumer access to these services, and to achieve better outcomes for service providers.

The project is unique in its scale, operating over four regions in four different jurisdictions: Western Australia, Queensland, South Australia and Northern Territory. It will work across the many levels of the service system from heads of governments to end consumers, including people working in state government departments, regional offices, private sectors providers, and Aboriginal organisations.

##### ***Desert services that work:***

- Demand for services
- Supply of services
- Interface between providers and users
- Preferences for specific types of services
- Different technological options.

The research team consists of 16 experienced researchers and three PhD students from eight different universities and research centres. As partnerships with Aboriginal organisations and government departments gain strength, Aboriginal leaders and service providers will also be drawn into the research team. There is also a steering group, composed of a mixture of researchers, Aboriginal leaders and services providers.

The project will bring together three different types of knowledge: the local knowledge of residents of desert Australia; the scientific knowledge of academic researchers; and the administrative knowledge of service providers. The greatest challenge for the project is to develop a project structure for robust research, which is responsive to the expressed needs and priorities of competing users and interests groups.

The broad purpose of the project is to improve livelihoods in desert settlements from

---

<sup>25</sup> M. Parnell and K. Seemann, "Developing lifecycle models for sustainable investment in desert communities", <http://www.desertknowledgecra.com.au/research/settlements.html>.

<sup>26</sup> <http://www.desertknowledgecra.com.au/research/services.html>

better access and effectiveness of services. The five questions all research must respond to are:

1. What are the perceptions, definitions and indicators of the interface between the demand and supply sides of services, which satisfy both consumer needs for access, and service-provider needs for outcomes?
2. What are the conditions that permit productive interpersonal relationships and successful practice to develop between consumers and service-providers?
3. What are the preferred functions at which scales for services to desert settlements, in satisfying both demand and supply based criteria?
4. What are the service type and delivery style priorities of consumers within a restricted budget framework, and what is their capacity to benefit from, and willingness to contribute to services?
5. What are the strengths and weaknesses of different technologies and governance options for desert settlements, and what are the critical issues and strategies that can provide leverage for change?

A very accessible methodology will be utilised. Community members will be trained and paid to do research. Easy-to-understand maps of services will help local people to understand services and what they do, and don't do. Local people will be assisted to draw up plans for how to get better services. Strong stories about successes and good new ideas will be shared.

## **2. Centre for Arid Zone Research (CAZR)**

The Centre for Arid Zone Research (CAZR) is situated in Alice Springs, Northern Territory, and provides a research base for a number of scientists engaged in research projects studying arid and semi-arid rangeland ecology and natural resource management including socio economic and policy aspects.<sup>27</sup>

The centre is a regional laboratory of CSIRO Sustainable Ecosystem's Rangelands and Savannas Program, which operates projects studying desert/arid land environments, tropical savannas, rangeland systems and ecosystem function analysis.

The overall goal of its research is to contribute to better regional planning for sustainable habitation of the Australian rangelands. Most of its work is carried out in collaboration with other government agencies and research institutions both in Australia and overseas.

CSIRO is required to take a strategic national view in its research; we work with colleagues from a range of other agencies at Territory/State and national levels to increase the knowledge and understanding about the Australian rangelands. This knowledge also contributes to the concept of a Desert Knowledge Economy in inland

---

<sup>27</sup> <http://www.cazr.csiro.au/about.htm>.

Australia, based on making our collective expertise and experience available to others around Australia and overseas.

CAZR's research involves the ecology and management of the arid and semi-arid rangelands of Australia. These are dominated in area by the pastoral industry, Aboriginal lands and conservation reserves, but dominated in economic output by mining and tourism.<sup>28</sup>

***Centre for Arid Zone Research:***

- Ecology and management of arid rangelands
- Promote community participation in planning
- Regional modeling (Outback Atlas)
- Precision pastoralism
- Regional ecological conservation
- Bio-graze: Sustainable grazing systems
- Understanding small business experiences
- Rangeways: Community-based regional land-use planning
- Sustainable use of aboriginal land.

Australia's rangelands are also subject to a wide range of newly diversified land uses, most of which occur on small areas. Pressures internationally and nationally mean that the traditional industries of the rangelands are changing the ways in which they operate, becoming non-viable in some areas, accessing new markets from others. Many regions are suffering social and economic disruption in this process, and all regions need to chart clearer courses during this new century.

The programme works with land managers, industries and policy makers to contribute to better planning, use, and management of the rangelands and to avoid the poorly implemented development that has occurred in many areas. Research is conducted on ecosystems respond to disturbances such as fire, grazing, and climate and to develop a more integrated view of the economic, environmental and social trade-offs of land use at enterprise and regional scales.<sup>29</sup>

CSIRO's scientists have been involved in developing better ways to balance conservation and land use.<sup>30</sup> Land use planning in the arid lands has tended to be highly centralised and driven by the collection of data which is often under-utilised. It has often been uni-sectoral rather than integrated across sectors and then runs the risk of being susceptible to influence by vested interests. Implementation has been undermined by conflict between regional and central government policies and is often not supported by institutional arrangements.

An alternative model has received widespread support during the 1990s. It is characterised by community participation at regional level and equity amongst stakeholders, regardless of their skills and resources. Integration of economic, social and environmental objectives is fundamental and an effective framework for negotiating change, including policy, is a feature. Decision-making is driven by information, not political lobbying by individual stakeholder groups.

<sup>28</sup> <http://www.cazr.csiro.au/research.htm>.

<sup>29</sup> <http://www.cazr.csiro.au/research.htm>.

<sup>30</sup> <http://www.cazr.csiro.au/modelling.htm>.

Research in support of regional planning can address a diversity of issues, including community involvement involved in regional planning, the design of institutional structures, the creation of partnerships with governments in different regions, and the selection of appropriate policies and planning instruments which could be developed to suit regional needs.

State and national governments will be better placed to assist regions with institutional processes that best suit their circumstances, and to support them with appropriate policy and resources. Community and government resources will thus be better utilised, whether environmental, social or economic.

There are several examples involving CSIRO scientists in collaboration with other sectors and stakeholders:

*1. Regional modeling (Outback Atlas)*

One of the main principles emerging from work on defining healthy savannas is that people are part of the system and that social and economic issues play a key role in natural resource management. A recent study on modeling in regional dynamics has shown the great differences between the issues faced in Outback Australia compared with those faced in more densely settled areas. In addition, there is considerable diversity in the issues faced by different parts of the Outback, and this can get overlooked by general representations of remote areas. In this context, the idea of developing an Outback 'Atlas' is being proposed as a way of helping to define and represent issues and indicators that characterise viable and socially desirable regions. Unlike a conventional Atlas, the idea is to produce a dynamic atlas that will integrate and disseminate research and also help target future activities.

*2. A sustainable pastoral industry*

Most pastoral lands are leased from the government. Pastoralists obtain a financial benefit from the use of land. In exchange, pastoralists contribute to the national economy and manage vast tracts of the rangelands. The onus for the management of pastoral lands should rest with the leaseholder. They are in the best position to take quick and responsive action as seasonal conditions change. However, this must be within appropriate government guidelines, formulated and monitored to ensure sustainable resource use.<sup>31</sup>

*Towards precision pastoralism:* By working on the economics of the industry in different regions, and by determining how viability is affected by productivity, markets and policy, we aim to understand how and where this major land use can contribute to the future of the rangelands. As a result of the highly variable climate and the vastness and

---

<sup>31</sup> <http://www.cazr.csiro.au/pastoral.htm>.

infertility of the landscape, stocking rates and fire are the main tools available to pastoral managers. Managers are learning to use these tools to intervene at the critical times and work with the natural ecological forces of the land to improve the management of the pastoral rangelands.

The Australian Collaborative Rangeland Information System (ACRIS) is a coordinating mechanism that brings together rangeland information from State, Northern Territory and Commonwealth agencies and other sources. Several land management guides also have been compiled.

### *3. Regional conservation planning*

CSIRO's CAZR Scientists are developing and costing new approaches to off-reserve conservation, based on an understanding of how native plants and animals use landscapes that are highly variable in time and space. They are also refining techniques for monitoring biodiversity to demonstrate the effectiveness of management actions. Incorporating these conservation network design principles into pastoral land management, and showing that they work, is doubly beneficial. Biodiversity can be protected within a production system, and pastoralists can gain market recognition for "environmentally-friendly" practices.<sup>32</sup>

### *4. Telling Outback business stories*

In order to highlight innovative desert businesses, a pilot project to tell their stories was conducted by CSIRO's Centre for Arid Zone Research in Alice Springs, with the support of Desert Knowledge Australia. Australians' knowledge of their own desert-based enterprises is limited. The focus is on the stories of successful innovation by desert small and medium enterprises (SMEs), in order to help other businesses adopt similar practices.

There are two case studies in the pilot project:<sup>33</sup>

- Littlefish Pangaea, which works with remote Aboriginal communities in central Australia to present complex financial reports as simple graphics and icons, making reports easy to understand for those with little business experience.
- Diab Engineering, a Geraldton based business that services the mining industry in remote locations.

The plan is to undertake 18 more case studies, and then to create websites whereby Outback businesses can network with one another, in areas such as agriculture, indigenous products, sustainable energy, mining and tourism.

---

<sup>32</sup> <http://www.cazr.csiro.au/conservationplanning.htm>.

<sup>33</sup> [http://www.cazr.csiro.au/documents/SecretsofDBP41\\_6.pdf](http://www.cazr.csiro.au/documents/SecretsofDBP41_6.pdf).

The future of some regions in Australia is strongly linked to tourism, Australia's second biggest industry. Within such regions tourism has a primary effect on most other regional industries, as well as on infrastructure needs and the quality of life of the local population.

In central Australia, tourism plays a major role in regional development and investment. The project addresses the following questions: What is the short-term future of tourism? How can we sustainably grow the industry and ensure the continued provision of flow-on benefits it provides to the region? In what direction is tourism heading; what are the rates of change in the factors affecting its future; and what implications does it have for other industries in the region? What strategies can be adopted to best ensure its sustained success?

Most strategic planning exercises related to tourism deal with collecting data about trends and looking at alternative investments. However, in the absence of a formal understanding of how different factors interact with each other, it is hard to quantify the costs and benefits of alternative futures. The present project actively undertakes this 'systems analysis', using the best information available from data collection and from the heads of knowledgeable industry leaders.

A survey of tourism operators was conducted.<sup>34</sup> Workshops were held, to fine-tune questionnaires, because it was discovered that what tourism operators wanted to know was different from what researchers had envisaged. An online tool, called IPAT (Industry Performance Analyser – Tourism) was developed, to collect information continuously. It collects information such as occupancy, origin of visitors, visitor numbers, and visitor destinations. Surveys are also conducted of visitors, to assess visitor expectations and satisfaction.

A Tourism Investment Model has been developed, which consists of five elements: Market research, indigenous hospitality training, indigenous tourism enterprises, transport subsidies, and a marketing campaign.

## 5. *Bio-graze*

This project focuses on the development of off-reserve, regional conservation planning approaches which look after biodiversity in the context of a thriving pastoral industry (BioGraze).

The rangelands - the dry pastoral lands - make up about 60% of Australia and are home to many animals and plants. A high proportion of these are not affected by pastoral land use. Pastoralists know that there are grass and shrub species that change in abundance under different grazing pressures - some plants are "decreasers" under grazing, while

---

<sup>34</sup> [http://www.cazr.csiro.au/2005\\_leaflets/tourism\\_futures\\_2005.pdf](http://www.cazr.csiro.au/2005_leaflets/tourism_futures_2005.pdf).

others are "increasers". We now know that this pattern applies to most types of plants and animals. Furthermore, some decreaseers are so sensitive that they occur only where there is negligible grazing pressure. Areas with very light grazing pressure are usually a very long way from water points.

The number of water points in pastoral areas is increasing because this is good management, to spread grazing pressure. However, one result is that there is little land left that is lightly grazed. This may lead to the severe decline of those species that are very sensitive to grazing.<sup>35</sup>

Specific topics in this programme include: The location of water points; the demarcation of conservation areas and corridors; the conservation of areas with special habitats; and the economic implications of conservation farming. Each habitat is numbered, and located in relation to water points for livestock; the conservation target is then calculated, per area or per number of threatened species.

The costs of conservation include the costs of setting up a conservation area; the loss current and future grazing capacity; and the costs of ongoing maintenance. The benefits can be found in terms of national and regional conservation targets (e.g. international treaties); and green marketing of agricultural products.<sup>36</sup>

Environmental Management Systems (EMSs) are promoted.<sup>37</sup> An EMS measures the trajectory of change in an environmental project. Their application is typically in the industrial sector, and this represents a novel application of EMS methodology to the agricultural sector. The main criterion, as far as biodiversity is concerned, is to show that farming does not reduce the number of species. Performance criteria have to be determined for each region, and for each property.

GIS systems have been developed, catering for information such as: vegetation mapping, fencing and paddocks, land uses, water points, roads, towns and mines.<sup>38</sup>

## 6. *Rangeways*

This project promotes the development of community-based regional land use planning across all land uses in a region.

An alternative model has received widespread support during the 1990s.<sup>39</sup> It is characterised by community participation at regional level and equity amongst stakeholders, regardless of their skills and resources. Integration of economic, social and environmental objectives is fundamental and an effective framework for negotiating

---

<sup>35</sup> <http://www.cazr.csiro.au/documents/FactsheetNo2-Planning.pdf>.

<sup>36</sup> <http://www.cazr.csiro.au/documents/FactsheetNo3-Economics.pdf>.

<sup>37</sup> <http://www.cazr.csiro.au/documents/FactsheetNo5-EMS.pdf>.

<sup>38</sup> <http://www.cazr.csiro.au/documents/FactsheetNo1-GIS.pdf>.

<sup>39</sup> <http://www.cazr.csiro.au/modelling.htm>.

change, including policy, is a feature. Decision-making is driven by information, not political lobbying by individual stakeholder groups.

Research in support of regional planning can address a diversity of issues. How can the community become effectively involved in regional planning? What are the options for institutional structures, given the ways different regions might form partnerships with governments? What are the appropriate policies and planning instruments which could be developed to suit regional needs?

Regional communities and local government will benefit from participating in the development of institutional processes that are best suited to their particular needs. State and national governments will be better placed to assist regions with institutional processes that best suit their circumstances, and to support them with appropriate policy and resources. Community and government resources will thus be better utilised, whether environmental, social or economic.

From 1995, the Rangeways project researched community-based planning for ecologically sustainable land use in the Western Australian Goldfields. It developed collaboratively amongst a number of organisations and agencies including CSIRO's Centre for Arid Zone Research, and drew the involvement of all sectoral interests in the regional community as well as further agencies as it progressed. The project sought ways to identify and reconcile opportunities for different land uses while protecting biologically sensitive areas within the framework of community-based regional planning and Ecologically Sustainable Development policy. The outcome of this work are procedures that are applicable elsewhere in Australia's rangelands.

## 7. *Sustainable use of aboriginal land*

Land owned and managed by Aboriginal people occupies about 15% of the Australian rangelands. Most of this land lies in the more remote parts of Australia and has been little used for commercial enterprise. It also encompasses some of the least disturbed natural environments on the continent.<sup>40</sup>

While the population level in these areas is relatively low, it is also growing. The low level of commercial activity has meant that few opportunities for employment or income generation exist for the owners and residents.

Aboriginal people often have different views and values with respect to resource use, management, and the place of people and their social and cultural structures in the environment. These views and values have been developed from the extensive experience and knowledge of Aboriginal people, and the project aims to understand and integrate them more broadly into rangeland use and management. Several research projects have been designed, in partnership with Aboriginal people on Aboriginal-owned lands in the

---

<sup>40</sup> <http://www.cazr.csiro.au/aboriginallands.htm>.

areas of fire management, tourism, management of conservation areas, and regional models and economies.

## C. Africa

### 1. *The Arid Lands Information Network (East Africa)*

#### 1. *Information and Communications Technology (ICT)*

ALIN has incorporated innovative Information and Communication Technologies (ICTs) to improve dissemination of information. Among the ICTs widely associated with ALIN-EA is the WorldSpace technology.<sup>41</sup>

ALIN is part of a global initiative enabling thousands of marginalized and poor people to share local knowledge widely supported by a range of technologies. The Open Knowledge Network project seeks to bridge the digital divide and harness the power of ICTs to assure opportunity, empowerment and inclusion for all.

ALIN has joined hands with other ICTs players to implement the Online Information Service for Non-Chemical Pest Management in the Tropics project.

#### 2. *Online pest information*

In Kenya, ALIN (East Africa), in collaboration with the Kenyan Ministry of Agriculture, Mwingi district, is one of the four organisations implementing the Online Information Service for Non-Chemical Pest Management in the Tropics (OISAT) pilot project in Kenya. OISAT, an initiative of Pesticides Action Network (PAN) Germany, is coordinated by Participatory Ecological Land Use Management (PELUM) Kenya.

#### *Arid Land Information Network:*

- Information and communications technology
- On-line pest information
- Information services for farmers
- Capacity-building, exchanges, lobbying, networking
- Newsletter: *The Baobab*.

OISAT Info is a practical guide for trainers, extension workers and farmers on how to minimize pest damage in a safe, effective, and ecologically sound way. It is a web-based source of information for crop production and non-chemical pest prevention providing affordable preventive and curative non-chemical pest management practices.

<sup>41</sup> <http://www.alin.or.ke/work/ict.asp>.

Information provided via the website [www.oisat.org](http://www.oisat.org) is relevant to small-scale farmers who intend to produce crops using safer and more affordable non-chemical pest management practices.

### 3. *The Kyuso project (information services for farmers)*

ALIN (East Africa) partnered with the Ministry of Agriculture, Mwingi, to implement the pilot within Kyuso division, Mwingi district. The partners set up a Farmers Resource Centre (referred to as Kyuso Community Information Supermarket) that is equipped with various appropriate Information and Communication Technologies (ICTs). These include a computer, a WorldSpace radio and a Digital Data Adapter, a printer, a mobile phone, and several data CD-ROMs.

Farmers have access to information on OISAT CD-ROM among other disks with various development technologies and experiences. Access to the internet will be made possible through the General Packet Radio Service (GPRS) technology. This centre is solar powered.

To make it a true 'information supermarket' ALIN-EA has incorporated the OKN project and established a Focal Group in Kyuso. This body comprising farmers, government workers, and CBO leaders will not only be in charge over the centre, but will also benefit greatly from the numerous information sources at their disposal.

### 4. *Rural networks and focal groups*

A Focal group (FG) is a congregation of ALIN members drawn from the same geographical location.<sup>42</sup> The network helps in convening the introductory meeting allowing members to interact and know each other. Thereafter, the members are expected to hold meetings to discuss local development issues. During the inaugural meetings, the members brainstorm on local networking opportunities, weaknesses, and strengths among other common issues. Meanwhile, the Secretariat visits the members on a regular basis. Through the FG approach, ALIN-EA is able to pool immense human resources and skill to move the development agenda of a region. The members are able to network at local level with the Network assisting them acquire modern ICTs to ease information access. ALIN-EA maintains a database detailing contacts, interests, and areas of work of all the members. The Network uses this valuable resource-base as a networking tool

### 5. *Capacity building*

*Exchange visits:* Since its inception, the network has been helping Community Development Workers (CDWs) to share their experiences in a direct and practical manner, through visits that expose them to what others are doing. ALIN facilitates CDWs

---

<sup>42</sup> <http://www.alin.or.ke/work/networking.asp>.

to undertake exchange visits outside their areas of operation and across national borders. This exercise has enabled many network members to replicate ideas cross national and regional borders.<sup>43</sup>

ALIN holds regular workshops intended to improve the skills of the community development workers and community members as well. The thematic workshops sensitize, equip and enlighten the members. The Network has conducted numerous ICT training workshops as well as Writing and Documentation trainings for the members. ALIN uses these forums to train members on new technologies and practices in development.

ALIN organizes Information Open Days with the aim of creating awareness among the communities, policy makers, pupils, teachers and development workers, on existing information resources provided by the network and other partner activities. During this day, participants learn more about local information generation, modern communication methods and various development information dissemination strategies. The occasion is also used to assess the community information needs.

#### 6. *Lobbying and advocacy*

ALIN joins other players in advocating for fairer policies especially in relation to information and the drylands development and was key in the formation of the Kenya Civil Society World Summit on the Information Society (WSIS) Caucus. The Caucus represents the Civil Society Organisations in Kenya in the sub-regional and global meetings of the World Summit on the Information Society.

ALIN took over the co-ordination of the Caucus during the year 2003 and raised money to support the activities such as, training civil society members on policy issues and participation at the World Summit on Information Society in Geneva, 2003.

#### 7. *ALIN's publication: The Baobab*

For 17 years, ALIN-EA's driving force has been the focus on information on dry land issues and targeting change agents at the grassroots. The Network is well known at the grassroots level and has published over 45 issues of its flagship publication, the Baobab. The journal, which is published three times a year, comprises case studies depicting best development practices in the African drylands. *Baobab* is primarily a forum for members to exchange ideas, experiences, and challenges with over 90% of the articles coming from members.<sup>44</sup>

---

<sup>43</sup> <http://www.alin.or.ke/work/capacity.asp>.

<sup>44</sup> <http://www.alin.or.ke/publications/baobab.asp>.

## **2. Namibia Desert Research Foundation**

The Namibia Desert Research Foundation works closely with the Gobabeb Training and Centre, located in Windhoek.

Research topics include:

- Community decision-making and participatory local poverty assessments
- Renewable energy systems
- Networking with ecological experts in arid areas
- Desertification and community-based responses
- Desert fauna and flora
- Rural energy systems, including solar power
- The ecology of desert dunes.

NDRF and the Gobabeb Centre have a partnership focusing on Long-term environmental monitoring. Long-term ecological research (LTER) is regarded as a powerful tool for understanding environmental processes and monitoring their changes at local to global scales.<sup>45</sup> The Environmental Long-Term Observatories Network of southern Africa (ELTOSA) is a regional network of country Environmental Observatories Networks (EON) with a broader focus on the natural environment and its social context, giving LTER an African flavour. Six African countries initiated ELTOSA in 2001 in order to support the UN-Conventions on Desertification, Climate Change, Biodiversity and Endangered Species, and Wetlands in the region. EON contributes to effective natural resource management as a basic component of sustainable development, and it involves the documentation, analysis and information dissemination concerning long-term large-scale ecological and socio-economic processes that are elucidated through multi-disciplinary research and monitoring over a network of institutionally operated field observation sites.

## **3. Morocco**

One desert project was undertaken by the “Institut agronomique et vétérinaire”, in Rabat, Morocco. Dr Mustafa Ismaili-Alaoui’s research interests include medicinal and aromatic plants, agroindustrial processing, appropriate technologies, biodiversity conservation, and biotechnology. The Canadian IDRC (International Development Research Centre) was the main funder for the project.<sup>46</sup>

### ***Institut Agronomique, Rabat***

- Biotechnology
- Production of essential oils, e.g. verbena, thyme, wormwood, rosemary
- Exports.

<sup>45</sup> J. Henschel and J Pauw, “Environmental Observatories: LTER á-la-Africa”, [www.drfn.org.na](http://www.drfn.org.na).

<sup>46</sup> [http://www.idrc.ca/es/ev-43248-201-1-DO\\_TOPIC.html](http://www.idrc.ca/es/ev-43248-201-1-DO_TOPIC.html).

An agro-industrial engineer trained at IAV, Mustapha Ismaili-Alaoui subsequently specialized in biotechnology. With an IDRC grant in 1990, he and his IAV colleagues set out to breathe new life into the essential oils industry in the poor Southern Atlas region where smallscale livestock husbandry and subsistence farming are the main sources of income.

The essential oils industry on these arid plains and hillsides has changed little over the centuries. Distillers travel the countryside by truck, buying harvests of wild plants — mainly verbena, thyme, and wormwood (artemesia) — and processing them on the spot. The goal of the project, carried out in collaboration with Agriculture and Agri-Food Canada's Horticulture Research and Development Centre (HRDC) in Saint-Jean-sur-Richelieu, Québec, was to "develop a technology that met international standards so that these products could compete on the international market."

As the research team worked to fine-tune improved equipment for extracting essential oils from artemisia and verbena, they learnt a great deal about the composition of these plants and their essences. Two low-cost pilot stills were developed. Easy to assemble and transport, they can also be manufactured by local tinsmiths and use plant residue as fuel. The project marked a first for Morocco: its verbena oil found a foreign buyer.

Dr Ismaili-Alaoui then turned his attention to rosemary, which grows wild on Morocco's sandy slopes and plains. Morocco exports 60 tonnes of its essential oil a year. To find ways of exploiting this resource rationally and sustainably, he launched a company — Tafilalet Arômes Méditerranée (TAROMED) in 1999. Its first project, supported by the Ministry of Water and Forests, Errachidia's governor, and the Tafilalet association, focused on some 10,000 hectares where the rosemary had never been exploited. A large company, Les Arômes du Maroc, was brought in as partner.

Access roads have been built through the rocky hillsides and water supply points provided. A distillation facility was also set up, using results from the earlier IDRC-supported projects. For the local community, the project created 50,000 days of work in 1999-2000, and yielded revenues of about 160,000 dirhams (CA \$23,000). Some families' incomes increased six-fold.

The Ministry of Water and Forests has now asked for his assistance in developing similar cooperatives throughout the country. None of this would have been possible without the knowledge gained through the olive biotransformation and aromatic plants projects supported by IDRC. Work is continuing to optimize the quality and yields of essential oils, and to train students in the technologies developed.

## **D. The United States**

### **1. Office of Arid Lands Studies: University of Arizona**

The Office of Arid Lands Studies (OALS) is a multidisciplinary research, instruction, and knowledge transfer unit in the College of Agriculture and Life Sciences at the University of Arizona in Tucson. The slogan of the OALS is “understanding and managing drylands”.<sup>47</sup>

#### *Office of Arid Lands Studies:*

- Computerised decision support systems for natural resource management in arid areas
- Food security assessment and monitoring of crops in arid areas
- Land use planning in arid areas
- Water and land conservation, and irrigation management.

The key programme areas are the following:

#### *1. Decision Support Systems Development*

A decision support system can be defined as a computer aided system that provides data, structured models and ad-hoc query tools to enable decision development and analysis. Over the past five years, OALS has been involved in developing decision support tools, mainly for natural resource management, primarily in Arizona and the Southwest. These have drawn upon its abilities in information and knowledge management, including remote sensing. The projects include:

- Arizona FIRE MAP
- Assimilation of NASA Science Results and Data into National Decision Support Systems
- Basics of Vegetation Monitoring for Rangelands
- Climate and Human Contributions to Fire Regimes Affecting Ecosystems in the U.S. Southwest
- Dryland Vegetation Dynamics and Landscape Vulnerability to Wildfire
- Malawi Environmental Monitoring Programme (MEMP)
- Models and Modes of Enabling the Use of NASA Earth Science and Data in Decision Making
- RangeView: Geospatial Tools for Natural Resource Management
- Sonoran Desert: People, Policy, and Place - Working for Sustainable Desert Living
- Urban Integrated Pest Management

<sup>47</sup>

<http://www.arid.arizona.edu/>.

- Wildfire Alternatives (WALTER)

## 2. *Food Security Assessment and Agricultural Monitoring*

Monitoring of agricultural crops throughout the growing season was one of the earliest applications of satellite remote sensing and it remains an important activity within OALS.<sup>48</sup> Using satellite data, it is possible to estimate cropped area and, often, to identify specific crops. Using time series satellite data it is possible to monitor the progress of the growing season. By comparing the current season to past seasons or averages of previous seasons, it is possible to make some predictions about harvests or the quality of the season.

Since 1987, OALS has worked in applying these approaches to agriculture in general, but also to assessing food security situations in Africa through the use of famine early warning systems. To determine whether a problem is imminent, in addition to monitoring the growing season, it is also necessary to monitor those things that might suggest whether a population is in distress, such as cereal and livestock prices in local markets. OALS has worked with the Food and Agriculture Organization of the United Nations, the U.S. Agency for International Development, NASA, and the U.S. Department of Agriculture both to develop new decision support tools and to design new approaches and integrated systems for monitoring agriculture and food security.

Projects in this area include:

- Assessing Animal Manure/Compost Applications on Irrigated Agricultural Fields for Nutrient Planning
- Malawi Environmental Monitoring Programme (MEMP)
- Role of Irrigation Water in Contamination of Imported and Domestic Fresh Food.

## 3. *Land Use Planning and Management*

Land-cover and land-use mapping and management are today an essential component of most environmental and ecological studies. Applications include an improved understanding of natural and anthropogenic change of both the natural and built environment and the relationships between these changes and the social and economic drivers of change. Acquiring a true understanding of these components is critical to successful and sustainable management of our resources.

## 4. *Water and Land Conservation and Reclamation*

---

<sup>48</sup> [http://www.arid.arizona.edu/Program\\_Areas/area.asp?areaid=3](http://www.arid.arizona.edu/Program_Areas/area.asp?areaid=3).

. Projects include examination of the fates of emerging contaminants during wastewater treatment in natural systems, environmental fate of endocrine disrupting compounds in biosolids after land application, efficacy of “smart” irrigation control for residential landscapes, promotion of biodiversity conservation via drug discovery in native plants, and watershed data collection and assimilation to promote semiarid watershed management.<sup>49</sup>

## 2. **Arizona Rural Policy Institute (ARPI)**

The Arizona Rural Policy Institute (ARPI) at the W. A. Franke College of Business is authorized and funded in part by the US Department of Commerce Economic Development Administration (EDA). University Centers improve the economies and economic development capacity of their service areas, with emphasis on economically distressed communities. ARPI is also a unit of the Center for Business Outreach (CBO), and collaborates extensively with the CBO's other divisions: the Center for American Indian Economic Development, the Computer Training Center, and the Bureau of Business & Economic Research. RPI also receives funding and support from the City of Flagstaff and Coconino County. Its focus areas are:

### **Arizona Rural Policy Institute (ARPI)**

- Focus on economically depressed regions in arid areas
- Rural policy analysis
- Studies of business incentives.

- Applied Research: Rural Policy Analysis, Labor Market Analysis, Business Surveys, Economic Impact Studies and Economic Modeling
- Technical Assistance: Work Force Development Assistance, Grant Consultation for Non-Profits, Tribal Entrepreneurial Training and Strategic Planning, Market Research and Feasibility Analysis, Business and Operating Plans
- Information Dissemination.

A useful report, “Business incentives in the Four Corners States: Models for Rural Arizona”, has generated information on the desert economy. The report covers economic growth in four arid states – Arizona, Colorado, New Mexico and Utah.<sup>50</sup> Economic growth has been largely concentrated in urban areas. The report argues that, in order to help rural Arizona improve its ability to expand and attract businesses, policy makers should analyse the successful business attraction methods used by other governments and organisations.

<sup>49</sup> [http://www.arid.arizona.edu/Program\\_Areas/area.asp?areaid=90](http://www.arid.arizona.edu/Program_Areas/area.asp?areaid=90).

<sup>50</sup> Jeff Peterson, “Business incentives in the Four Corners States: Models for Rural Arizona”, Arizona Rural Policy Institute, Center for Business Outreach, Northern Arizona University, October 2007.

Some of the current business attraction methods used by local municipalities in Arizona, are the following:

- Aggressively pursuing target industries, such as the motion picture industry, aviation and aerospace, renewable energy, bioscience, and manufacturing.
- Enterprise Zone programmes which open up economically depressed areas for tax credits, tax reductions and rebates
- Workforce training programmes, including reimbursements by the state of costs associated with training new or incumbent workers
- Colorado's Job Creation Performance Incentive Fund, which encourages the creation of new jobs
- Business incubators which provide a variety of services to small businesses

### **3. University of Arizona Economic & Business Research Centre**

The Economic & Business Research Center (EBR) was founded in 1949 with the purpose of practical investigation and study of business and economic problems. Its objectives are the collection, analysis, arrangement, and dissemination of economic facts to:

- Promote the development and utilization of Arizona's resources
- Assist business and government units intelligently to deal with present problems and to plan for the future
- Train and assist faculty and students in the field of business and economic research.<sup>51</sup>

#### ***Economic and Business Research Centre***

- Assist business and government with economic planning
- Research on business promotion strategies
- Research on the economic impact of the space industry and planetary sciences.

The EBR has compiled an economic outlook for Arizona, for 2008/9 (see saved document).<sup>52</sup>

#### **1. Business promotion by towns and cities in Arizona**

The EBR has also produced a report on *The role of Arizona Cities and Towns in the State's Economy*.<sup>53</sup> The report draws attention to the strong business focus of many small-town municipalities:

<sup>51</sup> <http://ebr.eller.arizona.edu/overview/historyEBR.aspx>.

<sup>52</sup> <http://ebr.eller.arizona.edu/publications/outlook/Outlook0809.pdf>.

<sup>53</sup> Tanis J Salant, A. Charney and MJ Vest, "The role of Arizona cities and towns in the state's economy", Economic and Business Research Center, Eller College of Management, University of Arizona, Tucson, October 2006.

“Economic development is now considered to be an integral part of our policy calculations in areas of local government responsibility previously considered separate and unrelated, such as arts/cultural/recreation programs (e.g. libraries, parks and recreation, performing arts facilities) environmental management, housing, neighbourhood services, and redevelopment”.<sup>54</sup>

The list of business-oriented activities is long and varied:

- Free pre-development meetings on project design and site development
- Expedient plan review
- Full-time economic development advisers
- Funding the chamber of commerce
- Funding the regional economic development organisation
- Funding the convention and visitors bureau
- Promoting the Main Street Program, which aims at preserving and refurbishing central commercial areas
- Cultural arts programmes
- Long-range planning
- Technical assistance for start-up small businesses
- Maps and plans
- Business and development outreach
- Public art
- Creating a pro-active business development climate
- Department of economic development
- Small business resource centre
- Urban planning and design
- Workforce development.

## 2. *Economic impact of space sciences*

A study has been undertaken by the Eller College of Management, on the economic impact of astronomy, planetary and space sciences (APSS) research in Arizona.<sup>55</sup> This has direct relevance for towns such as Sutherland, Carnarvon and Williston, in the Karoo, because of the new investments in telescopes in these areas.

The report refers to the space sciences research at Arizona’s three universities, astronomical observatories and related research organisations. The impact is evaluated in terms of jobs, wages and salaries, due to money brought into a region’s economy, mostly

---

<sup>54</sup> Salant *et al* (2006), page 12.

<sup>55</sup> V Pavlakovich-Kochi, A Carney and L Mwaniki-Lyman, “Astronomy, Planetary and space sciences research in Arizona: An economic and tax revenue impact study”, Eller College of Management, University of Arizona, October 2007.

from federal government sources. Direct impact occurs when scientific institutions hire professionals, faculty, staff and students and thus contribute to the overall employment. Additional jobs are generated through local purchases of equipment, office supplies, utilities, and business services. Jobs are also created by tourists and out-of-state visitors.

The report found that Arizona's eleven observatories and three related research organisations spent a total of \$135.4 million on operations, including payroll with benefits. An additional \$28.4 million was spent on capital investment and construction-related items. Thus, in Financial Year 2006, total expenditures amounted to \$163.8 million, of which \$69.3 million was spent in Arizona.

The participating APSS organisations employed a total of 1 830 people, of whom 320 were students. The total payroll was \$84 million, of which \$64.8 million was spent in Arizona. This spending generated 720 additional jobs and \$26.3 million in additional wages and salaries in Arizona.

Tourists from outside the state spent \$16.1 million in Arizona, generating an economic impact of \$25.7 million in total, as well as 286 jobs in Arizona.

#### **4. The Office of Arid Lands Studies (OALS), University of Arizona**

OALS consists of various divisions and programs:<sup>56</sup>

- One of the first to be established was a division to study arid lands plants as potential economic resources. Now called the Southwest Center for Natural Products Research and Commercialization, it also conducts research on the medicinal value of arid lands plants.
- The Arizona Remote Sensing Center uses remote sensing technology and geographic information systems to solve agricultural and natural resource problems in arid areas, while the Desert Research Unit conducts research on water conservation, wastewater treatment and reuse, reclamation of disturbed lands, policy studies, and environmental assessments.
- OALS also houses an economic development

##### ***Office of Arid Lands Studies (OALS):***

- Research on arid plants
- Remote sensing and geographic information systems
- Research on economic development
- Information exchange network
- Decision support systems
- Food security assessment and agricultural monitoring
- Land use planning and management in arid areas
- *Arid Lands Newsletter*
- Transboundary water management
- Climate change
- Desert architecture
- Alternative water and sanitation systems

<sup>56</sup> <http://ag.arizona.edu/OALS/ALN/aln52/>

research program that conducts broad-based studies dealing with economic and demographic change in Arizona, and that provides technical assistance to state agencies.

- Lastly, but integral to all of the Office's work, has been the Arid Lands Information Center (ALIC) which grew directly out of the original Army Research Office grant.

*The Arid Lands Information Center*<sup>57</sup>: Currently, the Information Center houses a collection of more than 30,000 documents, including many one-of-a-kind technical reports and manuscripts. It also has special collections that resulted from a number of large development projects, particularly in West Africa. Throughout the years, ALIC has been involved in generating a variety of publications including information papers, proceedings, directories, and a twice-yearly journal, the *Arid Lands Newsletter*. It has also used database management systems to create specialized databases, bibliographies, and online information resources. Demand for technical assistance to create similar capabilities for other information centers has generated contract activities outside the U.S. in such countries as Chile, Argentina, Mexico, India, Bahrain, Egypt, Kenya, Mauritania, Niger, and the Yemen Arab Republic. In recent years, ALIC has become a major producer of value-added web sites dealing with arid lands and agricultural information.

The Internet has provided the foundation for pursuing a wide range of projects. Now the Center operates as an information dissemination component for large multi-disciplinary efforts focused on diverse topics. This involves partnering with other departments and colleges, and collaborating with many different agencies and organizations. In most cases, the focus is on disseminating information in a way that can be useful for different levels of users. However, there is also a commitment to preserving information and data, facilitating access, and redesigning the data into practical decision-making tools.

One example of this process is the Arid and Semi-Arid Watersheds website developed in cooperation with the U.S. Forest Service. This site brings to the public 40 years of data collected as part of the Arizona Watershed Program, a project which began in the 1950s. Incorporated under an umbrella of general information about Western watersheds is a searchable database of watershed treatment data, including a GIS interface, which allows users to manipulate the data in new ways.

Similarly, the Arizona Rangelands web site project incorporates many of these same characteristics. Begun as a component of the national Agriculture Network Information Center (AgNIC), the web site has grown into a western regional initiative involving 12 other states, and is the umbrella site for many related sub-projects that have developed specific information modules and tools. One is the database of Ecological Site Guides for Arizona that are used by the Natural Resources Conservation Service (NRCS) and other agencies for making land management decisions; another is a series of remote sensing

---

<sup>57</sup> <http://cals.arizona.edu/OALS/IALC/About/about.html>.

tools for range management developed by the Arizona Remote Sensing Center through a NASA/Raytheon-funded program.

Since 1966, ALIC has provided specialized information services, spanning the full range of library functions, to the University of Arizona community, the public, government agencies, and international development organizations. Demand for technical assistance to create similar capabilities for other information centers has generated contract activities in such countries as: Chile, Argentina, Mexico, India, Bahrain, Egypt, Kenya, Mauritania, Niger, and the Yemen Arab Republic.<sup>58</sup>

ALIC personnel work on projects in these Program Areas:<sup>59</sup>

1. *Decision Support Systems Development*

A decision support system can be defined as a computer aided system that provides data, structured models and ad-hoc query tools to enable decision development and analysis. Over the past five years, OALS has been involved in developing decision support tools, mainly for natural resource management, primarily in Arizona and the Southwest. These have drawn upon in-house skills in information and knowledge management, including remote sensing.

2. *Food Security Assessment and Agricultural Monitoring*

Monitoring of agricultural crops throughout the growing season was one of the earliest applications of satellite remote sensing and it remains an important activity within OALS. Using satellite data, it is possible to estimate cropped area and, often, to identify specific crops. Using time series satellite data, it is possible to monitor the progress of the growing season. By comparing the current season to past seasons or averages of previous seasons, it is possible to make some predictions about harvests or the quality of the season. Since 1987, OALS has worked in applying these approaches to agriculture in general, but also to assessing food security situations in Africa through the use of famine early warning systems. To determine whether a problem is imminent, in addition to monitoring the growing season, it is also necessary to monitor those things that might suggest whether a population is in distress, such as cereal and livestock prices in local markets. OALS has worked with the Food and Agriculture Organization of the United Nations, the U.S. Agency for International Development, NASA, and the U.S. Department of Agriculture both to develop new decision support tools and to design new approaches and integrated systems for monitoring agriculture and food security.<sup>60</sup>

3. *Land Use Planning and Management*

---

<sup>58</sup> <http://www.arid.arizona.edu/Divisions/division.asp?div=ALIC>.

<sup>59</sup> <http://www.arid.arizona.edu/Divisions/division.asp?div=ALIC>.

<sup>60</sup> [http://www.arid.arizona.edu/Program\\_Areas/area.asp?areaid=3](http://www.arid.arizona.edu/Program_Areas/area.asp?areaid=3).

Land-cover and land-use mapping and management are today an essential component of most environmental and ecological studies. Applications include an improved understanding of natural and anthropogenic change of both the natural and built environment and the relationships between these changes and the social and economic drivers of change. Acquiring a true understanding of these components is critical to successful and sustainable management of our resources.<sup>61</sup>

#### 4. *The Arid Lands Newsletter*

ALIC has produced a variety of publications with worldwide distribution, including the semiannual *Arid Lands Newsletter*.<sup>62</sup> It contains many useful articles, such as:

- Water harvesting in third world arid areas<sup>63</sup>
- Water recycling in Windhoek, Namibia<sup>64</sup>
- Rain water harvesting in urban areas<sup>65</sup>
- Inner city water efficiency<sup>66</sup>
- Urban grey water use in Tucson, Arizona<sup>67</sup>
- Using geospatial technologies to develop participatory tools for natural resources management<sup>68</sup>
- Assessing Capabilities of Soil and Water Resources in Drylands: The Role of Information Retrieval and Dissemination Technologies<sup>69</sup>, including watersheds and soil analysis,
- Cultural issues, biodiversity, marketing indigenous products, and ethnobotany<sup>70</sup>
- Climate change<sup>71</sup> and the Convention to Combat Desertification (CCD)<sup>72</sup>
- Desert architecture and housing styles<sup>73</sup>
- Ecotourism in arid areas<sup>74</sup>
- Urban agriculture<sup>75</sup>
- Conflict resolution and transboundary water resources<sup>76</sup>

---

61 [http://www.arid.arizona.edu/Program\\_Areas/area.asp?areaid=4](http://www.arid.arizona.edu/Program_Areas/area.asp?areaid=4).

62 <http://ag.arizona.edu/OALS/ALN/about-aln.html>.

63 <http://ag.arizona.edu/OALS/ALN/aln57/bruins.html>.

64 <http://ag.arizona.edu/OALS/ALN/aln56/dupisani.html>.

65 <http://ag.arizona.edu/OALS/ALN/aln56/raghavan.html>

66 <http://ag.arizona.edu/OALS/ALN/aln56/holden.html>

67 <http://ag.arizona.edu/OALS/ALN/aln56/brightman.html>.

68 <http://ag.arizona.edu/OALS/ALN/aln53/aln53toc.html>.

69 <http://ag.arizona.edu/OALS/ALN/aln52/aln52toc.html>.

70 <http://ag.arizona.edu/OALS/ALN/aln48/aln48toc.html>

71 <http://ag.arizona.edu/OALS/ALN/aln49/aln49toc.html>.

72 <http://ag.arizona.edu/OALS/ALN/aln40/aln40toc.html>.

73 <http://ag.arizona.edu/OALS/ALN/aln47/toc47.html>.

74 <http://ag.arizona.edu/OALS/ALN/aln43/aln43toc.html>.

75 <http://ag.arizona.edu/OALS/ALN/aln42/aln42toc.html>

76 <http://ag.arizona.edu/OALS/ALN/aln44/aln44toc.html>

- Transboundary management of arid areas and nature reserves, and in particular, the Sonora desert of Mexico and the southern US<sup>77</sup>
- The future of arid lands<sup>78</sup>
- Desert ecosystems<sup>79</sup>

Electronic subscriptions to the *Newsletter* can be arranged by e-mail.

## 5. ***International Sonoran Desert Alliance (ISDA)***

ISDA is a non-profit corporation founded in 1993 and governed by a board of directors representing the indigenous and non-indigenous populations of the U.S. and Mexico.<sup>80</sup> It is a group of concerned people from all walks of life who have joined forces to:

- promote the concept and practice of conservation throughout the bio region;
- provide education in ways of protecting and respecting valuable biological and cultural resources and traditions;
- develop creative and sustainable solutions to critical local issues such as housing and economic development;
- and provide practical opportunities for individual and community action.

### ***International Sonoran Desert Alliance (ISDA)***

- Ecological conservation
- Sustainable housing
- Economic development in arid areas
- Computer training to local communities
- Local arts
- Business promotion.

ISDA also hosts public meetings that provide opportunity for broad community participation, and seeks input from a wide cross-section of voices and cultures. At its board meetings, business is conducted in three languages-English, Spanish, and O'odham, and literature, books, leaflets and website, are bilingual. Thanks to funding, training, and technical assistance from the W. K. Kellogg Foundation, ISDA is now part of a five-year national Rural People, Rural Policy Initiative.

ISDA has initiated several projects:

#### 1. *Curley School artisan housing*

ISDA has rehabilitated the historic and formerly abandoned Curley School in Ajo, a former copper-mining town in southern Arizona. The building contains 30 affordable

<sup>77</sup> <http://ag.arizona.edu/OALS/ALN/aln39/laird.html>;

<sup>78</sup> <http://ag.arizona.edu/OALS/ALN/aln39/fuller.html>.

<sup>79</sup> <http://ag.arizona.edu/OALS/ALN/aln59/waser.html>.

<sup>80</sup> <http://www.isdanet.org/ISDA%20about%20us.html>.

live/work rentals for artists of all media and creative home businesses.<sup>81</sup> The Curley School's eight buildings, spread out over a seven-acre campus, offer 114,000 square feet of apartments, classrooms, workshops, a huge auditorium with an indoor-outdoor stage and computer lab. The main building, an architectural masterpiece of Spanish Colonial Revival style, was built in 1919. Additional buildings were added to the campus in 1926 and 1937. Renovation was completed in 2007. The Curley School is on the National Register of Historic Places and is located in the beautiful and historic heart of Ajo.

## 2. *Computer training*

In April 2006, ISDA opened a 10-station computer lab on the Curley School campus that will support e-commerce development, workforce skills development, and life-long learning for all ages.<sup>82</sup> Classes have been very popular, providing professionally taught lessons on internet and email access, Windows, Word, Excel, PowerPoint and Access to people of all ages and backgrounds.

## 3. *Enterprise centre*

As a means of encouraging the growth of existing and new micro businesses, ISDA will soon provide business services (copying, printing, shipping & receiving, addressing, etc.), business consulting, and business skills workshops with emphasis on the needs of artisans and creative businesses.<sup>83</sup>

## 4. *Shop girls*

To help women and girls gain skills, confidence, and an entrepreneurial spirit, ISDA offers a series of workshops in which the "shop girls" learn to use power tools to create items they can sell or use-so far: tables, lamps, birdhouses, and a bench. Shop Girls is modeled on the Girls with Tools program developed by the Zuni Avenue Peace Center in Tucson.<sup>84</sup>

## 5. *Native gardens*

The continued viability of the Sonoran Desert depends, in part, on the success of its native pollinators - bees, birds, bats, beetles and butterflies-which in turn depend upon easy access to the nourishment provided by native flowering plants.<sup>85</sup> Many nectar sources have been lost to recent area-wide drought. ISDA's pollinator garden program seeks to create gardens of native plants that act as nectar corridors connecting the natural habitats protected in the Pinacate, Organ Pipe, Cabeza Prieta, and the Sonoran Desert National Monument. ISDA volunteers have created community, school, and residential gardens in Gila Bend and Ajo, Arizona. In 2004, ISDA co-published *Pollinators of the*

---

<sup>81</sup> [http://www.isdanet.org/curley\\_school\\_artisan\\_housing.htm](http://www.isdanet.org/curley_school_artisan_housing.htm).

<sup>82</sup> <http://www.isdanet.org/ISDA%20computer%20lab.htm>.

<sup>83</sup> <http://www.isdanet.org/ISDA%20enterprise%20center.htm>.

<sup>84</sup> <http://www.isdanet.org/ISDA%20shop%20girls.htm>.

<sup>85</sup> <http://www.isdanet.org/ISDA%20native%20gardens.htm>.

*Sonoran Desert*, a colorful 162-page, bilingual field guide to the animal species that pollinate our region.

#### 6. *Shifting sands initiative*

Thanks to a planning grant from the Ford Foundation, in 2007 ISDA will begin participating in the Foundation's Shifting Sands Initiative. The purpose of the Initiative is to assist communities that are experiencing significant demographic and economic change - such as Ajo - to explore how arts and culture can be pivotal in preserving cultural identities at risk of being lost.<sup>86</sup> During the planning grant period, ISDA will sponsor dialogues in Ajo to explore the use of public art installations and community festivals that would bring Ajo's rich multicultural heritage to the forefront. In its first year, our initiative will focus on Ajo's Native American cultural heritage.

#### 6. ***International Center for Arid and Semi-arid Land Studies (ICASALS)***

The International Center for Arid and Semiarid Land Studies (ICASALS) at Texas Tech University was created in 1966 to promote the university's special mission of the interdisciplinary study of arid and semi arid environments and the human relationship to these environments from an international perspective. The purpose of ICASALS is to stimulate, coordinate and implement teaching, research, and public service activities concerning all aspects of the world's arid and semiarid regions, their people and their problems. ICASALS is a component of the Office of International Affairs (OIA) of the Texas Tech University. ICASALS brings together the sciences, technologies, humanities and arts with a particular emphasis on applied research and education concerning those regions where loss of productivity and declining water resources are of tremendous significance to the inhabitants and the economies involved.<sup>87</sup>

##### ***International Center for Arid and Semi-arid Land Studies (ICASALS)***

- Water resources: Hydrology, water quality, water recycling
- Agriculture: Soil sciences, irrigation, and land
- Energy sources: Wind power, alternative fuels
- Environment: Air quality, ecosystems, and weather and climate
- Land use and planning
- Geology and mineral resources.

The Center deals with the following issues:

- Water resources: Hydrology, water quality, water recycling
- Agriculture: Soil sciences, irrigation, and land
- Energy sources: Wind power, alternative fuels
- Environment: Air quality, ecosystems, and weather and climate

<sup>86</sup> <http://www.isdanet.org/ISDA%20shifting%20sands.htm>.

<sup>87</sup> <http://www.iaff.ttu.edu/home/icasals/index.asp>.

- Land use and planning
- Geology and mineral resources
- Geospatial technologies
- Remote sensing
- Decision support systems, and
- Education and training.

ICASALS held a conference in November 2006, entitled: *Water in Arid and Semi-Arid Lands: Innovative Approaches and Informed Decision-making*.<sup>88</sup>

## 7. **ARIDNet**

Arguments surrounding the topic of desertification create confusion in policy and management programs intended to help many of the world's poorest people. Hence, there is an urgent need for new, interdisciplinary approaches for addressing this global problem.

“ARIDNet” stands for: **A**ssessment, **R**esearch, and **I**ntegration of **D**esertification research *network*. ARIDnet will provide the leadership to support on-going international discussions and strengthen recruitment of researchers, including undergraduate students, to study the principles, criteria, and policies related to global desertification, especially as outlined under the UN Convention to Combat Desertification.<sup>89</sup>

### **ARIDNET**

The Drylands Development Paradigm (DDP):  
Promote integrated ecological, economic and social development strategies.

The project is a partnership between several institutions. The Principal Investigator is Dr James Reynolds of the Division of Environmental Science and Policy, at Duke University. Other key players are Dr. Jeff Herrick (New Mexico State University); Dr. Elisabeth Huber-Sannwald of Instituto Potosino de Investigación Científica y Tecnológica (IPICYT), in Mexico; and Dr. Miguel Ayarza (CIAT-Honduras).<sup>90</sup>

ARIDNet is a research network for studies of global desertification. It is funded by the US National Science Foundation. Its goal is to provide leadership for developing and testing a new synthetic paradigm for desertification. *The Drylands Development Paradigm(DDP)* is based on the simultaneous roles of the meteorological and ecological dimensions of desertification (the *biophysical* factors) and the human dimensions of desertification (the *socio-economic* factors).

<sup>88</sup> <http://www.iaff.ttu.edu/home/icasals/PDFs/Newsletter05sequentialpgs.pdf>.

<sup>89</sup> <http://www.biology.duke.edu/aridnet/>

<sup>90</sup> <http://www.biology.duke.edu/aridnet/ARIDnet%20english/governance.htm>.

*The Drylands Development Paradigm (DDP)*<sup>91</sup>: The DDP addresses the livelihoods of human populations in drylands, via the study of coupled human-ecological (H-E) systems. It is a product of a diverse array of research in desertification, vulnerability, poverty alleviation, and community development and consists of 5 principles, all of which have implications for research and management in drylands.

Five general lessons are espoused by the authors of the DDP:<sup>92</sup>

- The purpose of the model is to promote integrated ecological, economic and social development strategies.
- There needs to be a heightened awareness of slowly evolving conditions. Short-term measures tend to be superficial and do not resolve persistent, chronic problems, nor deal with continual change.
- Non-linear processes need to be recognised: Dryland systems are not in equilibrium, they have multiple thresholds, and thus often exhibit multiple ecological and social states.
- Cross-scale interactions must be anticipated – problems and solutions at one scale may influence, or be influenced by, those at other scales.
- A much greater value must be placed on local environmental knowledge (LEK).

ARIDNet focuses on :

- conducting workshops to debate the paradigm, and to formulate working groups to develop comparative case studies to test the DDP;
- to conduct a quantitative synthesis of what matters in land degradation, when and where it matters, and why;
- to recruit new researchers and stakeholders into *ARIDnet* so a broad-based and useful approach to land degradation and development problems can be explored

**Table: The Drylands Development Paradigm**

Principles	Key implications for research and management
H-E systems are coupled, dynamic and co-adapting, so that their structure, function and interrelationships change over time	1: Understanding dryland desertification and development issues always requires the simultaneous consideration of both human and ecological drivers

**P2:** A limited suite of ‘slow’ variables are critical determinants of H-E system dynamics  
**2:** A limited suite of critical processes and variables at any scale makes a complex problem tractable

<sup>91</sup> [http://www.biology.duke.edu/aridnet/ARIDnet%20english/ddp\\_New.html](http://www.biology.duke.edu/aridnet/ARIDnet%20english/ddp_New.html).

<sup>92</sup> James F Reynolds, D Mark Stafford Smith, *et al*, “Global desertification: Building a Science for Dryland Development”, *Science*, vol. 316, 11 May 2007, pp 851. Found at [www.sciencemag.org](http://www.sciencemag.org), and at [http://www.biology.duke.edu/aridnet/pdfs/Science%20papers/2007-Reynolds\\_Science.pdf](http://www.biology.duke.edu/aridnet/pdfs/Science%20papers/2007-Reynolds_Science.pdf).

**P3:** Thresholds in key slow variables define different states of H-E systems, often with different controlling processes; thresholds may change over time

**3:** The costs of intervention rise non-linearly with increasing land degradation or the degree of socioeconomic dysfunction; yet high variability means great uncertainty in detecting thresholds, implying that managers should invoke the precautionary principle

**P4:** Coupled H-E systems are hierarchical, nested and networked across multiple scales

**4:** H-E systems must be managed at the appropriate scale; cross-scale linkages are important in this, but are often remote and weak in drylands, requiring special institutional attention

**P5:** The maintenance of a body of up-to-date LEK (local ecological knowledge) is key to functional co-adaptation of H-E systems

**5:** The development of scientific and local ecological knowledge must be accelerated both for local management and regional policy

## E. India

### 1. *Central Arid Zone Research Institute (Jodphur, India)*

The CAZRI's mission includes:<sup>93</sup>

- To undertake basic and applied researches that will contribute to the development of sustainable farming systems in the arid ecosystem.
- To act as repository of information on the state of natural resources and desertification processes and its control.

It pursues the following projects:

1. *Integrated Basic and Human Resources Appraisal, Monitoring and Desertification*, including natural resources surveys, land evaluation, GIS, soil fertility, desertification, hydrology, wind erosion, crop-weather relationships, and alternative land use systems for medicinal plants.

#### *Central Arid Zone Research Institute*

- Natural resources surveys, land evaluation, GIS, soil fertility, desertification
- Indigenous and medicinal plants
- Biodiversity conservation
- Agriculture, agroforestry, horticulture
- Management of forage land
- Watershed management, underground water, rehabilitation of waste land
- Alternative energy, solar power
- Women in agriculture.

2. *Biodiversity Conservation, Improvement of Annuals & Perennials*, including improvement of arid zone trees, conservation of arid rangeland shrubs, studies of

<sup>93</sup> <http://www.cazri.res.in/objectives.html>.

- threatened plant species, study of underexploited indigenous fruits in the arid region, development of high yielding crop hybrids.
3. *Integrated Arid Land Farming System Research*, including integrated farming systems, arid cropping systems, agroforestry and agrihorticultural systems for arid areas.
  4. *Management of Land and Water Resources*, including performance of arid forage grasses, artificial recharge of ground water, watershed management, and rehabilitation of degraded wastelands.
  5. *Improvement of Animal Production and Management*, particularly Marwari sheep and goats.
  6. *Plant Products and Value Addition*, including products of economic importance from arid zone plants, such aloe vera.
  7. *Integrated Pest Management*, including insects and rodents.
  8. *Non-Conventional Energy Systems, Farm Machinery & Power*, including development of greenhouses and solar devices.
  9. *Socio-economic issues*, including gender issues, socio-economic conditions of migratory sheep and goat farmers in arid areas, economic analyses of livestock production systems, farmers' perception on tillage and residue management, arid land technology transfers, and women's self-help groups.

## **2. Institute for Development Studies, Jaipur (IDSJ)**

The Institute of Development Studies in Jaipur was established in 1981 on the initiative of a group of academics, scholars and administrators of Rajasthan. It is supported by the Indian Council of Social Science Research (ICSSR) and the Government of Rajasthan, a largely arid province. The Institute receives support from various national and international organisations interested in research and development. The Institute is an autonomous organisation registered under the Societies Registration Act, 1860.<sup>94</sup>

In Rajasthan, over 60% of the land area is a desert environment and the bulk of its remaining area receives less than 60 cm of annual precipitation. Water is the most scarce resource and critical to the survival and livelihood of the people of Rajasthan and several other parts of India.

---

<sup>94</sup> <http://www.idsj.org/>.

The main objectives of the Institute include:

- to contribute to the understanding of the development processes and problems;
- to focus studies on the issues and problems of the by-passed sections and regions;
- to bring a multi-disciplinary and collaborative approach in studying and resolving the issues; and
- to provide a forum for the interested groups in resolving problems of importance to the State and its people by mutual discussion and understanding.

Particular attention is given to the study of processes, the impact of trickle down effects of growth, direct public interventions such as poverty reduction and employment generation programmes, and the participatory efforts of voluntary organisations with respect to the marginalised sections of the society. The Institute is specifically concerned with regional issues relating to Rajasthan.

The Institute has several key research areas:<sup>95</sup>

### *1. Economic Policies and Strategies*

Studies and dialogues in this area include:

- Agriculture, food security, farm inputs particularly fertilizer and irrigation, capital formation, marketing, and liberalization of agriculture.
- The livestock sector studies at the Institute have covered economics of sheep and goat rearing, marketing of wool, goat, goat products and other live animals; inter-sectoral linkages, livestock services and dairy processing.
- non-farm sector, employment pattern in the handicrafts and rural industries, and the system of credit delivery to this sector.
- Urban informal sector was studied with a focus on labour market, child labour, employment and income.
- The issue of poverty and management of poverty alleviation programmes (PAP) and livelihood adaptation has been the central focus of a number of studies and dialogues.
- rural finance and credit

### ***Institute for Development Studies (IDSJ)***

- Economic policies and strategies:  
Agriculture, food security
- Livestock
- Urban informal sector
- Urban poverty
- Rural finance and credit
- Water management
- Biodiversity in arid areas.

### *2. Natural Resource Management: Water*

<sup>95</sup> <http://www.idsj.org/research2.htm>.

The Institute is attempting to influence the water use policy for water scarce regions. Its studies pertain to the demand for water, supply of water and allocative mechanism, both institutional and market. In each of these sub-sets, relevant studies have been undertaken with a view to eventually influencing the water use policy, strategies and attitudes towards water.

- On the supply side, IDSJ studies have covered rainfall patterns, ground water and surface water sources.
- As regards demand side issues, studies have covered demand for drinking water, irrigation, other uses, water markets and pricing of water, water laws, water pollution, local water management options, water balance modeling, economic evaluation of water projects and bench marking of irrigation projects have been covered by our studies and dialogues.
- The role of communities in water conservation and issues relating to ownership and control of water received added emphasis.

### *3. Livestock*

Livestock is critical for the people of Rajasthan. The Institute initially accorded priority to the small animals, viz., sheep and goats, as these are important components of the farming systems in various regions. The goat and sheep breeders do not often fetch remunerative prices due to their weak forward linkages with the market and processing industry. The Institute has probed the linkages and identified areas of interventions at various levels for improving the incomes of goat and sheep breeders.

In recent years, studies have extended our studies on dairying, impact of commercialization of livestock services on poor, and to cover role of local institutions in improving the productivity of grazing lands.

### *4. Forestry and Biodiversity*

Studies include issues relating to environment and development; environmental economics, watershed management, and degradation of lands. Land reforms and land use patterns have also received the attention of researchers at the Institute.

With a view to monitoring the status of natural resources, the Institute has established a laboratory to interpret the images available from satellite remote sensing. Based on these, the resource use plans for sustainable development of selected areas in both irrigated and dry land regions are being worked out. Remote sensing technology has also been used in our studies on 20 irrigation projects and identification of performance indicators for Rajasthan Water Resource Consolidation Project.

## **F. Middle East**

### **1. Center for Jewish-Arab Economic Development**

The Center for Jewish-Arab Economic Development (CJAED) is a non-profit organization, established in 1988 by a group of Jewish and Arab businesspeople. The guiding principle of the Center and its activities is that Jewish-Arab economic cooperation in Israel is essential for peace, prosperity and economic stability in Israel and the region at large. CJAED acts on the premise that Israel's primary resource is its people; that Israel's strength lies in its pluralism and democracy, and that the Arab community must be integrated into the Israeli mainstream economy and society.<sup>96</sup>

The Arab community comprises 20% of Israel's c. six and a half million citizens. Over 45% of Arab families are poor (in contrast to 15% of Jewish families), with high levels of unemployment.

The national and economic security and stability of Israel as well as the health of the Israeli society are contingent upon mutual trust between Jews and Arabs, a trust sorely lacking at present. To this end, CJAED seeks to integrate the Arab community into full partnership in the Israeli economy by both economically empowering this community, as well as promoting Jewish-Arab economic co-operation and joint ventures. CJAED also acts as an umbrella organization initiating the establishment of new local organizations which ultimately become independent and empower the local communities within which they are found.

#### ***Centre for Jewish-Arab Economic Development***

- Promoting Arab businesses, and creating linkages with Jewish businesses
- Empowering women
- Promoting desert tourism enterprises
- Promoting indigenous crafts.

CJAED spearheads a large array of projects and activities in different areas, with each project belonging to one of the following four units: Business Unit; Women Empowerment Unit; Building Business Bridges (BBB); and Municipal Unit. Each unit is headed by one of the Center's team members, and employs the external services of professionals in the different fields.

Several activities, programs and events either headed or coordinated by CJAED have greatly impacted public policy regarding the integration of the Arab community into Israel's mainstream economy and society.

#### **1. Northern Triangle Tourism Project**

<sup>96</sup> <http://www.cjaed.org.il/Index.asp?CategoryID=98>.

Since 1997, the Center for Jewish Arab Economic Development has been engaged in a comprehensive process to lay the foundations for building sustainable tourism in the Wadi Ara region. This project was initiated with the goal of highlighting to the residents of this area, the importance of preserving the natural reserves and landscape which are threatened by the rapid residential and industrial development.

The plan also takes into consideration the necessity to weigh the impact of tourism in terms of the local society and culture, and to ensure that the local community receives an equitable share of the tourism's economic benefits. The plan is the product of a comprehensive survey, and resulted in the creation of the Ahlan Tourist Board as well as the mapping of all 21 villages (between Zemer and Megido) and topographical landmarks of the area. A blue-print for the development of Wadi-Ara has been prepared and the ongoing project management is now being implemented.<sup>97</sup>

## 2. *Lakiya: Bedouin women weavers of the Negev*<sup>98</sup>

Lakiya Negev Weaving (the Bedouin women weavers' cooperative) was established in 1991 as an income generating project for Bedouin women in the Negev. Today it plays a vital role in enabling approximately 50 women achieve personal empowerment and financial self sufficiency. Lakiya Negev Weaving produces hand-woven carpets, by using pure handspun wool and natural dyes, and by using traditional and modern designs.

Prior to CJAED's involvement, the Lakiya project was mainly a social project, supported by various organizations and donations, and never realizing its full business potential. During the course of 2005, the Bedouin women's organization, Sidreh, approached CJAED in order to receive financial consultation as to how to launch Lakiya's activity into a financially profitable business, allowing more Bedouin women in the Negev to reap the fruit of their ability to work. CJAED's involvement has resulted in the creation of a two-year recovery program for Lakiya, designed to increase sales and production in order to enable Lakiya to provide employment for a significantly larger number of Bedouin women.

## 2. **Centre for Desert Architecture and Planning (CDAUP), Ben Gurion University**

CDAUP is part of the Blaustein Institute for Desert Research (BIDR), which is located at the Sede-Boqer Campus of Ben-Gurion University of the Negev (BGU) in the heart of Israel's arid southern region. The unit is part of The Department of Man in

<sup>97</sup> <http://www.cjaed.org.il/Index.asp?Category=1>

<sup>98</sup> <http://www.cjaed.org.il/Index.asp?Category=1>

### ***Centre for Desert Architecture and Planning***

- Desert habitation, construction technology
- Urban form
- Regional development
- Reducing energy requirements in desert buildings
- Alternative energy

the Desert, together with the unit for Social Studies.<sup>99</sup>

Through a combination of applied research, architectural design, and educational outreach, the Center for Desert Architecture and Urban Planning addresses the issue of building in the desert - particularly the Negev Desert of Israel.

- Researchers at the Center identify, study, and formulate solutions to specific problems of desert habitation, which stem both from natural conditions, such as resource availability and climate, and from human issues which take on special significance in an arid environment: thermal comfort, energy consumption, construction technology, urban form and regional development.
- In addition to research, the Center engages in the design of selected architectural projects. These innovative works allow the expertise accumulated in the Center to be applied to actual design problems. Completed projects are utilized for monitoring and analysis, and for demonstration of the possibilities of bioclimatic architecture in the desert.

Appropriate desert architecture is a crucial component of settlements in arid areas. Despite the environmental implications, man's dependence on non-renewable energy resources continues to increase. In Israel, the equivalent of some three tons of oil per person is expended in a single year - and as in most developed countries, some 40% of this energy is consumed for heating, cooling, and making buildings habitable. When the energy costs of building construction and materials, on the one hand, and urban transportation, on the other, are added to this basic load, it becomes clear that most of society's energy use is influenced by architects and planners.

The burden of resource use in buildings or urban settings can be minimized in many ways, and the first requirement is a basic understanding of climate and local conditions. This "bioclimatic" approach to architecture may be applied in the desert as elsewhere, and its pertinence is in fact amplified:

- Often characterized as an "extreme" environment, the desert makes considerable inputs of natural resources, such as water and energy, necessary to provide acceptable levels of human comfort.
- The opportunities for utilizing "natural energies"- solar radiation, night ventilation, evaporation, or nocturnal sky radiation - are among the many passive systems and design strategies whose effectiveness is especially pronounced in an arid climate.

With sparse population and low rates of development, arid regions have typically received little attention from planning professionals. This means that standard building methods are predominantly adapted for non-desert conditions. However, overcrowding in the heavily populated centers of many countries is causing intense pressure for the

---

<sup>99</sup> <http://www.bgu.ac.il/CDAUP/>.

development of "peripheral" regions such as deserts - and accomplishing this in a sustainable manner is an imminent challenge.

### **3. Social Studies Unit, Ben Gurion University**

The Social Studies Unit is also part of the Jacob Blaustein Institute for Desert Research.<sup>100</sup>

Research topics in the Social Studies Unit include anthropology, sociology, regional development, human geography, and economic history of people in drylands. Interdisciplinary investigations also include resource and proactive contingency planning, and crisis management. Special attention is given to processes of urban and rural settlement of Bedouin.

Major research areas include:

- Studies of Bedouin culture and society, and the process of modernization of this traditional society
- Proactive contingency planning and interactive crisis management in drylands, including drought and desertification; drought planning and rainwater harvesting for arid-zone pastoralists in Kenya and Israel.
- Cooperative agricultural settlements in Israel, Nigeria, Zambia and Nepal.
- Pastoralism in the Middle East and Africa, and the development of villages for shepherds
- Interaction between nomads and agropastoralists in Botswana's Kalahari desert.
- Settlement in the Negev, with special emphasis on the Hebrew Israelite Communities of African-Americans, immigrants from the former Soviet Union and Mizrahi (Oriental) women.
- The political economy of agriculture in Israel and in developing countries: the politics and economics of agricultural technology transfer; the impact of agricultural R&D on economic development; and the decollectivization of the Israeli moshav and kibbutz and its consequences..

#### ***Social Studies Unit***

- Bedouin culture and modernization
- Climate change and water resources
- Co-operative agricultural systems
- Pastoralism and rural villages
- Comparative studies – Kalahari (Botswana), Nepal, India, Zambia
- New immigrants to Israeli desert areas
- The political economy of agriculture
- The future of kibbutzes.

Members of the unit are part of the Multilateral Working Group on the Environment, Initiative to Combat Desertification in the Middle East. The group is working with local farmers and shepherds to develop sustainable agropastoral systems. The first meeting took place in Amman, Jordan in 1996. Towards this end we worked together with

<sup>100</sup> <http://www.bgu.ac.il/social/index.htm>.

ICARDA, the World Bank, and delegations from the Palestinian Authority, Jordan, Egypt, Tunisia, and Turkey.

The unit organizes an annual seminar on Bedouin Society and Culture in cooperation with the Field Study Center at Midreshet Sede-Boqer. The lectures are published each year as *Notes on the Bedouin - A Series in Memory of Itzhak Netzer*. Thus far 31 issues have been published

#### **4. Israel Hi-Tech**

The *Israel High Tech & Investment Report* is a monthly subscriber insider newsletter written and published in Israel. Its independently prepared contents mirror Israel's activities in applied research and development. The Journal showcases emerging growth companies. Some of these companies have since become world leaders in their respective fields.<sup>101</sup>

Each month the report carries original material in the form of interviews, company analysis, and editorials, while giving coverage of news of the public companies on Wall Street and the Tel Aviv Stock Exchange. The country's world class multimedia, software, and Internet industries are a continuous feature of the newsletter.

##### ***Israel Hi-Tech***

- Using brackish water for irrigation – melons, tomatoes, flowers, olives, pears, grapes
- Solar energy
- Carbon sequestration in the desert
- Bedouin health, education and agriculture.

Readership includes the international media, governments, corporations, venture capitalists and financial institutions in Israel and around the world. The report is now in its 18th year of publication.

##### ***1. Using brackish water for agriculture***

A decade ago, even the most optimistic among the scientific community from Ben Gurion University, the Faculty of Agriculture of the Hebrew University and the Vulcani Institute, hardly believed in developing technologies that allow farmers in the desert to produce desirable and exportable qualities of melons and tomatoes. At an altitude of 350 meters above sea level in the desert, where the average annual rainfall is a scanty 97mm/year, during a recent visit at the Ramat Negev Desert Agro-Research Center, melons are grown in the sand and tomatoes raised in hothouses. Surprisingly, the tomatoes were sweeter than conventional tomatoes.

<sup>101</sup> <http://www.ishitech.co.il/about.html>.

The most important achievement of the research was the organoleptic improvement of the products using brackish irrigation. The improved taste was evident in tomatoes, olives, pears and wine grapes. The "Desert Sweet" tomatoes are sold in many European countries. Their research has been applied by Negev farmers. The technology has also been transferred to other countries.

How does desert farming work? Salinity in water causes "stresses" in plants and results in poor quality. Drip irrigation, an Israeli development globally exported, allows cultivation of crops with brackish and saline water. Drip irrigation assures a continuous flow into the soil. A constant dilution of the water is maintained. To obtain the proper level of salinity, fresh water delivered to the Negev, by Israel's National Water Carrier from the Sea of Galilee, is mixed with brackish water, obtained from wells in the desert. The wells' depth may reach up to 1,000 meters. In practice the water is pumped from depths of 300 meters, and when brought to the surface the water gushes out at a temperature of 100 degrees Fahrenheit. Water at the lower depths is "clean and bacteria free and has a low level of salinity. It mixes at depths of 300 meters, to provide the optimum saline level.

One of the keys of successful "desert farming" was the discovery that using fresh water only during the short periods when the plant is sensitive to salinity, and brackish water at other times was the best way. This mixing of water of different qualities gives superior results. Throughout the Negev area, which covers more than one fifth of Israel's total size, but has only one percent of the country's 7 million population, the application of the technologies developed, are readily visible to the eye with many of the vegetables being grown in greenhouses. Of open field vegetables, 25 salinity varieties have been tested, these include export grade melons and tomatoes. Sweet peppers are next in line. A decade of research has resulted in an improvement in the quality of many fruits and a noticeable higher level of sugar content, resulting in better taste, and a longer shelf life. Grapes for new wines are to be produced from vines already thriving in the Negev vineyards and irrigated with brackish water.

In future, new species of flowers and flower bulbs will be grown with fresh, brackish and hot water, all under plastic cover. Flowers grown in the wilderness are shipped to buyers in the United States. A newly developed hothouse computer to cellphone system which monitors various hothouse parameters is about to undergo rigorous trials to determine its marketability. Israel has attracted attention to its flower growing activities as it is the world's leader in flower exports to Europe, grossing about \$1.5 billion per annum, which is about 30% of all flowers imported by Europe. Israeli flowers have gained a high reputation following many years of investing in improving flower quality, developing new varieties that meet customer demand, rapid response to the changing fashions in the flower world, extending flower shelf life and shortening the packaging and shipping process.<sup>102</sup>

## 2. *Solar energy*

---

<sup>102</sup> *Israel High-Tech & Investment Report July 2001*, at <http://www.ishitech.co.il/jul01ar3.htm>.

Israeli company Solel, which develops solar thermal technology, has signed a contract with Pacific Gas and Electric Company (California) to build the world's largest solar plant in California's Mojave Desert. The trough-like array of mirrors will be spread over 9 square miles in the Mojave Desert, and will produce 550 megawatts of solar power.<sup>103</sup> This is part of California's aggressive targets to supply one-fifth of its energy from renewable sources, by 2010. The production cost for electricity, using this method, is about half of the more familiar rooftop photovoltaic cells.

Electricity will be produced using a six-foot trough-shaped mirror, that focuses rays of the desert sun on a pipe less than three inches in diameter, heating a fluid inside to 750 degrees Fahrenheit. The fluid will release steam to drive a turbine. Small motors will tilt the mirrors to keep them facing the sun. The solar plant will be built in the desert between the Nevada state line and Barstow, California.

### 3. *Greenhouse gas in the desert (carbon sequestration)*

A study in the Negev desert has shown that the Yatir forest, planted at the edge of the Negev desert 35 years ago, is expanding at an unexpected rate, because of the absorption of carbon dioxide (the main greenhouse gas causing global warming). The Negev research station is the most arid site in a world-wide network (FluxNet) established by scientists to investigate carbon dioxide absorption by plants.<sup>104</sup>

### 4. *Bedouin Research and Development Center, Negev Desert*

A regional research and development center for Bedouin researchers opened recently at Hura in the Negev. The centre will pursue research on desert agriculture, technology, health, education, culture and economics. The centre will be run by AHAD (Academics for the Advancement of Arab Society in the Negev), with academic supervision by Ben-Gurion University.<sup>105</sup>

Specific research topics include:

- Genetic and chronic diseases common in the Bedouin community
- Sheep farming
- Cultivation of medicinal herbs in the desert
- Solar energy production.

---

<sup>103</sup> *Israel High-tech & Investment Report*, September 2007, at <http://www.ishitech.co.il/0907.pdf>.

<sup>104</sup> *Israel High-Tech & Investment Report*, June 2003, at [www.ishitech.co.il/0603.pdf](http://www.ishitech.co.il/0603.pdf).

<sup>105</sup> <http://www.ishitech.co.il/1007.pdf>.

## **G. International agencies**

### **1. The Food and Agricultural Organisation (FAO)**

The FAO's Land and Water development Division has a focus on "The Drylands".

#### *1. Management Practices at Local/Community/Catchment Level*

Local people have for many years been considered by policy makers, academics and development workers to be incapable of managing common property resources in a sustainable manner. Customary tenure systems with their communal forms of ownership and management were considered to be archaic, locking people into a 'tragedy of the commons' scenario. The community was considered unable to stop individual users from over-exploiting the resource.<sup>106</sup>

The FAO studies decentralised natural resource management systems, which requires local populations and government institutions to participate actively and equitably in decision-making processes. A major challenge facing development organisations is to support this process in a way that is both sustainable and equitable.

#### ***Food and Agriculture Organisation (FAO)***

- Community management of natural resources, such as land and catchment systems
- Market dynamics in the drylands
- Raising production for export
- Problems of desertification
- Soil management
- Afforestation
- Pastoral nomad communities.

#### *2. Economic issues in the drylands*

International, national and local market dynamics and private and public sector financial flows are treated as indirect drivers of pastoral and agricultural practices of dryland people, driving either sustainable use of dryland natural resources, or desertification. The increasing focus on raising production for exports in Ghana (mostly semiarid) and Mexico (more than half of country arid to dry subhumid), for instance, has led to increasing degradation.

The FAO research material has a strong focus on degradation of drylands, soil management, afforestation, conservation agriculture, and pastoral nomad communities.

<sup>106</sup> <http://www.fao.org/ag/agl/agll/drylands/managementlocal.htm>.  
<http://www.fao.org/ag/agl/agll/drylands/economic.htm>.

## 2. **United Nations**

The UN Convention to Combat Desertification defines desertification as: "land degradation in arid, semiarid and subhumid tropics caused by a combination of climatic factors and human activities." Thus, work on desertification-related issues includes a wide range of topics:<sup>107</sup>

- local economic development,
- gender issues,
- poverty eradication,
- relief delivery and food security, and
- climate change research
- natural resources management
- ecology, zoology and botany of arid lands.

### **United Nations**

- Desertification
- local economic development,
- gender issues,
- poverty eradication,
- relief delivery and food security
- climate change research
- natural resources management
- ecology, zoology and botany of arid lands.

## **Conclusion**

South Africa has a great deal to learn from research conducted elsewhere in the world, particularly as regards economic investment in desert regions. In certain ways, our Karoo, Kalahari and Namaqualand areas are already well developed, particularly in terms of commercial agriculture and urban infrastructure. But there are new and pressing issues on the horizon, particularly with regards to climate change, the need for sustainable desert agriculture, the growth in international tourism, and the need to grow the enterprise base of the local economy, with particular emphasis on the involvement of black and low-income entrepreneurs.

The overview presented in this report has highlighted the following themes, which can guide South African Research and Development in arid areas:

1. Improving government service delivery in arid areas, particularly with regards to appropriate technology (housing, energy, water and sanitation)
2. Creating partnerships between established (often white-owned) and emerging (often black-owned) businesses
3. Promoting high-value desert products (particularly if they are low-cost, in terms of transport)
4. Promoting place-bound products (such as tourism sites)
5. Identifying desert cultural resources (e.g. indigenous knowledge and art)

<sup>107</sup> <http://ag.arizona.edu/cgi-bin/cstccd.cgi>.

6. Productive use of land by non-western communities, and by indigenous farmers, including sustainable grazing systems – this can have a major significance for commonage land in Namaqualand, the Kalahari and in peri-urban areas in the Karoo
7. Promoting community rangers on game farms and game reserves in the arid areas
8. Promoting environmental education for school learners in the arid areas
9. Production of indigenous crops and herbs
10. Improving local pastoral practices, particularly with regards to sheep and goats
11. Investigating, professionalising and promoting off-road tourism (e.g. 4x4 tourism)
12. Promoting business networking in the arid areas, including the creation of partnerships and consortia to bid for bigger projects
13. Creating realistic opportunities for the involvement of local black and coloured businesses in tourism enterprises
14. GIS and spatial planning systems that show business, agriculture and tourism projects, together with underground and surface water resources and transport systems
15. Assisting networking amongst emergent farmers in the Karoo, Kalahari and Namaqualand, and the introduction of internet-based information systems
16. Business incentives offered by municipalities, to attract investment
17. Business support systems for start-up businesses
18. Promote the Karoo space projects (telescopes) as a tourism destination, and maximise the multiplier effects of tourism activities in these areas
19. Promoting cross-border planning systems, whether across local, district, provincial or national boundaries
20. Researching population dynamics, poverty, and migration patterns.
21. Promoting cutting-edge, high-technology projects in arid areas, such as solar and wind energy and the effective use of water resources
22. Analyse the interaction between human and ecological systems (such as watersheds, ecologically sensitive areas, and grazing land).

These initiatives will require the creation of a strategic “Greater Karoo” economic agency, to identify economic options, lobby funders and decision-makers, and assist local stakeholders to network and to refine their business ideas. Such an agency should build up a repository of arid areas information and issue a newsletter, circulated to a data-base of entrepreneurs in the arid areas.