13 Bright Spots: Pathways to Ensuring Food Security and Environmental Integrity

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Introduction

One of the great achievements of modern agriculture has been to produce enough food to feed the largest global population ever known. This has, in part, been through innovations in plant breeding and fertilizer technologies, mechanization and intensification of cropping systems, enhanced water-use efficiencies through innovations in irrigation and rainwater harvesting, and improved disease and pest control. The ability of modern agriculture to ensure food security for everyone without associated negative impacts to the environment has, however, fallen short of what may be deemed to be an appropriate level. An estimated 800 million people do not have access to sufficient food supplies, mostly in South Asia and sub-Saharan Africa. It is estimated that some 2.8 billion people still struggle to survive on less than US$2/day. Half a billion people live in countries defined as water-stressed or water scarce and, by 2025, this figure is predicted to rise to between 2.4 and 3.4 billion (UNFPA, 2004). Unsustainable consumption and production patterns, coupled with rapid population growth, have had a significant impact on the environment. More people are using more resources with greater intensity and leaving behind a distinctive 'footprint' of environmental degradation. A rapidly growing and insatiable global consumer class is using resources at an unprecedented rate, with an impact far greater than their numbers.

Industrialized agricultural production systems have been successful in maintaining food supplies to a burgeoning global population since the mid-1980s. There has, however, been a cost both to the functionality of ecosystems, with respect to goods and services provided, and to human health. These often-assumed intangible externalities are beginning to be fully costed and documented (cf. Pingali and Roger, 1995; Crissman, *et al.*, 1998; Pretty *et al.*, 2000; Norse *et al.*, 2001; Tegtmeier and Duffy, 2004). There is growing concern that these highly industrialized production systems may not, in fact, alleviate food poverty.

A critical challenge facing the global community over the coming two decades is how to provide adequate levels of nutrition and opportunities for wealth creation in marginalized and disadvantaged communities. A wide variety of doomsday scenarios have repeatedly documented the growing role of agricultural systems in the degradation and depletion of natural resources, the pollution of the environment and the contamination of food products. These alarming trends and the increased incidence of drought associated with climatic variability and change, pest outbreaks (i.e. locust plagues in Africa and Australasia) and disease (i.e. avian flu in South-east Asia and north Asia) contribute to increased food shortages and the risk of famine. These factors all cast doubt on the capacity of the global agro-industry to provide sufficient, reliable and safe food supplies.

Land and water degradation pose a serious threat to household food security and the livelihoods of rural people who occupy degradation-prone marginal lands (Pretty and Koohafkan, 2002; Uphoff, 2002). Africa exemplifies the linkage between land and water resource degradation and food insecurity. Since the late 1960s, less than 40% of the gains achieved in African cereal production have been the result of increased yields per unit area. The majority of this gain was from the expansion of the agricultural land area (Rosegrant *et al*., 2001; Ford Runge *et al*., 2003). This has had a significant impact on land and water resources, soil fertility and food security at the household level. It has been suggested that producing more food per unit of land is an essential element in any successful effort to eliminate food insecurity and malnutrition in Africa (InterAcademy Council, 2005). There are, however, examples from around the globe of small-scale interventions that have been effective in reversing the downward spiral of poverty with concomitant positive impacts on land and water resources (Mutunga and Critchley, 2001; Pretty 2001; Pretty and Hine 2001; Banuri and Najam, 2002; Critchley and Brommer, 2003; Pretty *et al.*, 2003). These examples have been termed 'bright spots' in the published literature and are characterized by farmers and communities who have adopted innovative practices and strategies to reverse natural resource degradation in a sustainable manner whilst maintaining or enhancing food security (Scherr and Yadav, 1995). A characteristic of sustainable agronomic production systems is that they effectively make the best use of ecosystem goods and services whilst limiting damage to these assets, and potentially make use of a wide variety of technologies or practices, including genetically modified organisms, provided they are both safe and accessible to poor farmers (Conway, 1997; National Research Council, 2000; Pretty, 2002). These bright spots give us cause for cautious optimism, in that there is a perceptible movement towards sustainable farming practices that result in enhanced livelihoods with positive outcomes for the environment (see Box 13.1). In addition, by their very nature, these bright spots are more resilient to stress and, hence, less vulnerable.

In the discussion that follows, we undertake an assessment of the global extent of bright

Box 13.1. Africa Centre for Holistic Management

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The Wange community of north-west Zimbabwe typifies most of the problems that plague rural communities in Africa, namely desertifying land, the drying up of rivers, boreholes and dams, approximately 80,000 people in poverty, AIDS, constantly failing crops, dwindling livestock, the exodus of young people, poaching of nearby timber and wildlife in state lands and more, in a country experiencing violence, corruption and economic meltdown to an alarming degree. The Africa Centre is a local, not-for-profit organization established by Zimbabweans to reverse this situation meaningfully over time, starting in their own community but extending assistance throughout English-speaking Africa. All of the local problems are being addressed in a realistic manner through local drive and commitment.

This is an ongoing project, as neither reversing land degradation nor achieving lasting social change can be achieved through projects of short duration – no matter how well intended. For this reason the project is constantly referred to as a 100-year project. The project is based upon achieving the desired reversal of land degradation and all of its many symptoms – droughts, floods, poverty, social breakdown, violence, abuse of women and children, etc. – through empowering people to take charge of their lives and destiny by using an holistic decision-making framework developed by the Zimbabwean founder of the project.

The overall achievements to date are that the project is an island of calm in the chaos of today's Zimbabwe. There have been over 2000 village members trained through the conservation projects (grazing, homegardens, women's banks, wildlife management). War veterans are being trained as game scouts and actively catch poachers while sharing income from organized wildlife safari hunting. All the chiefs of the vast Wange communal lands are trustees and commit significant time and energy to governance of the Africa Centre. To date, 24 women's banks have been formed by over 500 women. While many people – black and white – have been losing land, four ranches have been added to the community's piece of privately held land, to enable the Africa Centre now to form a College of Agriculture, Wildlife and Conservation Management. The total land now managed by the Africa Centre amounts to more than 8000 ha. This land is held by the trustees for the good of the community and is dramatically improving, with vast increases in ground cover, and grass for animals and wildlife. In addition, water in boreholes is increasing, as one of the land's main rivers has once again almost become perennial in flow. Wildlife has increased tenfold or more on the project land.

Substantial training and coaching has been provided to the community on permaculture techniques and on grazing planning (to reverse land degradation and restore water to rivers and boreholes). Steps are being taken to establish a monitoring programme to formally capture the gains being made socially, environmentally and economically in the community in a comprehensive manner. Owing to the holistic grazing planning implemented by the Africa Centre on their land, a substantial number of the community's livestock were saved from death during recent poor seasons. Where the project land had previously been seriously deteriorating and was considered 'overstocked' with 100 head of cattle, the Africa Centre is currently running a herd of over 600 cattle, goats, pigs, donkeys and horses, with dramatic benefit to the land. The impact of the project at the watershed level is best illustrated with pictures taken on the same day. Figure 13.1 shows a dried-up riverbed devoid of neither base flow in the dry season nor riparian vegetation. The second photograph (Fig. 13.2) is the community's Dimbangombe River, where the Africa Centre is now showing the entire community how to revitalize the land and wildlife through managing land with livestock without the traditional role of fire. A few years ago these scenes would have looked similar.

Fig. 13.1. Degraded riverbed, common to the area.

Fig. 13.2. Restored river and riparian zone.

The Africa Centre land so far impacted by the project is just over 8000 ha, which is but a small percentage of the over 400,000 ha of the Wange communal lands, but it is their example and learning site. Now the work is being gradually extended to the areas of the two closest chiefs, Shana and Mvutu, whose people are currently receiving education, training and coaching.

Rivers originating in the Wange communal lands are often prone to flash flooding and are dry during the long winter dry season. The example of a rehabilitated river presented in Fig. 13.2 represents 'new water', in that it was not previously flowing into the river but was being lost largely to soil-surface evaporation. Such soil-surface evaporation is being reduced by the people through the control of fires, while increasing livestock numbers by using the technique of holistic grazing planning, developed by the Chair of the Africa Centre and now being used in a number of countries worldwide.

There are now approximately 500 women participating in the Africa Centre's women's microlending banks. These are in their fourth year of operation and continue to maintain a 100% payback rate, with most women reporting significant and encouraging changes to their household and food security. In addition, through its efforts the Africa Centre is providing employment for 100 or more people, as well as injecting many thousands of dollars into the community annually. Just over 8000 ha of land have benefited from this impact. Probably over 40 ha of improved small gardens are scattered across it, as well as gardens utilizing drip irrigation kits (provided by USAID, with distribution, training and administration provided by Africa Centre staff).

Establishing deep trust and acceptance takes time and patience. This important aspect is not encouraged by 3–5-year projects and demands for quick and quantifiable results. The process must be driven by local people, and developing a team of community leaders with the commitment and skills takes time.

spots, which focuses on quantifying yield improvements in productivity associated with the adoption of cost-effective technologies that enhance the performance of production systems with a move towards more sustainable farming practices. In addition, we discuss the possible drivers that resulted in the development of two contrasting forms of bright spots that have a community and individual focus.

Global Extent of Bright Spots

The concept of a bright spot in the current context encapsulates agricultural sustainability. We interpret this to mean the production of food products that makes pre-eminent use of an ecosystem's goods and services whilst not permanently damaging these assets (Pretty *et al*., 2006). There are numerous documented cases where intensification of agricultural production systems or the adoption of improved practices have resulted in increases in food production and wealth generation in communities, with a concomitant positive impact on ecosystem services (Mutunga and Critchley, 2001; Pretty, 2001; Pretty and Hine, 2001; Critchley and Brommer, 2003; Pretty *et al*., 2003) (Box 13.2). In a recently completed study, datasets from the SAFE World database of the University of Essex, UK (Pretty *et al*., 2000; Pretty and Hine, 2004), recently published success stories and new survey information (Noble *et al*., 2006) were compiled to form a bright spots database of successes. The cases that make up the database all have elements of resource-conserving technologies and practices, which include integrated pest and nutrient management, conservation tillage, development of agroforestry-based farming systems, aquaculture, water harvesting and livestock integration. Using a farming systems classification developed by FAO for the World Bank, these cases were grouped into eight broad categories which are based on social, economic and biophysical criteria (Dixon *et al*., 2001). The database comprises 286 cases from 57 countries. The impact of these bright spots has influenced 12.6 million households, covering an area of 36.9 million ha (Table 13.1). The largest number of farmers adopting improved management strategies were those under wetland rice-based systems, predominantly in Asia, whilst the largest area affected was under a dual mixed system, mainly in southern Latin America (Table 13.1). In the latter case, this comprises the adoption of conservation 'no tillage' agriculture practices in Santa Catarina, Brazil. The total area of 36.7 million ha that is engaged in transition towards sustainable agricultural production systems represents 2.8% of the total cultivated area globally. It is argued that these documented cases may only represent a small proportion of the farmer households who are adopting and moving towards more sustainable agricultural production systems.

Pretty and Hine (2004) identified four mechanisms used to improve household food production and income generation that are common to these projects, namely:

- Intensification of a component of the farming system, such as the development of homegardens for vegetable and fruit production, the introduction of fish into farm ponds or a dairy cow.

Box 13.2. Developing a grape production enterprise in North-east Thailand: an individual's initiative to diversify and intensify a farming system.

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A farmer and his wife have established a grape orchard on 0.8 ha close to the city of Sakon Nakon, north-east Thailand (Fig. 13.3). The total extent of the family farm is 8 ha, of which the remaining 7.2 ha is leased out to sharecroppers, who grow a single annual rice crop and remit 30% of the crop to the farmer as rent. The family unit consists of five children and the parents. What is unique about this farm is that it has not been subdivided amongst the children, and hence the integrity of the original farm has been maintained. This is of importance in assessing the overall viability of the farming unit. Three of the children have left the farm to take up positions in the civil service, leaving the current farmer, his wife, brother and parents on the farm. The farmer is young and well educated. Having completed school he trained in business administration. He then went and worked in a manufacturing company, where he acquired practical skills in mechanics and metalworking. On returning to the farm, he undertook a study tour to determine possible alternative options for the farm, all of which he paid for himself. He decided that grape cultivation was a viable option for the area, as there were no other farmers in the area growing the crop. A study tour to the southern grape-growing areas of Thailand taught him trellising and the cultivation of grapes, along with planting stock for his farm. Using microjet irrigation, he and his wife have established the orchard. There has been a substantial investment (US$12,195) in the project, drawing on household savings. The harvested grapes are sold at the farm gate to buyers, and hence no marketing of product is required. The farmer expects to make significant profits within the next 2 years.

Fig. 13.3. The proud farmer showing off his grape crop.

As a bright spot, this example demonstrates the role of outstanding leadership, aspirations, drive and the initiative of the farmer. From a sustainability perspective, the vineyard has a significantly reduced water requirement (i.e. drip irrigated) when compared with the previous enterprise of rice, which in a semi-arid environment reduces the need for the large storage capacity that would be needed to irrigate rice in the dry season. An important characteristic of this viticulture operation is that it keeps both the farmer and his wife occupied for 12 months of the year. The majority of farmers in the area are confined to growing a single crop of rice, which effectively employs them for 6 months of the year. Significant out-migration occurs from the area, as farmers move to Bangkok for employment on construction sites and driving taxis during the off-season. The success of this bright spot is based on the individual being highly motivated, as well as having acquired significant skills and, possibly more importantly, the financial capacity to invest in the development of the venture.

- The incorporation of new productive elements into the farming system, which could include the introduction of fish or shrimps into paddy rice fields, or trees, which provide an increase to total farm production and/or incomes.
- Better use of natural resources to increase total farm production, such as water harvesting and land reclamation/rehabilitation.
- Improvements in per ha yields of staple cereals through the introduction of new regenerative elements into the farm system, such as legumes, integrated pest management and new and locally appropriate crop varieties and animal breeds.

What is important in all of these cases is that a wide range of technologies and practices were used to enhance productivity, which resulted in improved soil health and fertility, more efficient water use under both dryland and irrigated farming systems and increases in in-field biodiversity through improved pest and weed management.

Table 13.1. Summary of adoption and impact of sustainable agricultural technologies and practices on 286 projects in 57 countries (Pretty *et al.*, 2006).

FAO farm system category[a]	No. of farmers adopting	No. of ha under sustainable agriculture	Average % increase in crop yields[b]
1. Smallholder irrigated	179,287	365,740	184.6 (± 45.7)
2. Wetland rice	8,711,236	7,007,564	22.3 (± 2.8)
3. Smallholder rainfed humid	1,704,958	1,081,071	102.2 (± 9.0)
4. Smallholder rainfed highland	401,699	725,535	107.3 (± 14.7)
5. Smallholder rainfed dry/cold	604,804	737,896	99.2 (± 12.5)
6. Dualistic mixed[c]	537,311	26,846,750	76.5 (± 12.6)
7. Coastal artisanal	220,000	160,000	62.0 (± 20.0)
8. Urban-based and kitchen garden	207,479	36,147	146.0 (± 32.9)
All projects	12,566,774	36,960,703	83.4 (± 5.4)

[a] Based on the farming systems classification of Dixon *et al.*, 2001.
[b] Yield data from 405 crop project combinations; reported as % increase (thus a 100% increase is a doubling of yields). Standard errors of the mean in parentheses.
[c] Dualistic refers to mixed large commercial and smallholder farming systems, mainly from southern Latin America.

Associated with the adoption of these technologies and practices, the average increase in crop yields over all farming systems was 83.4% (Table 13.1). There was, however, a wide spread in improved yields, as indicated in Figs 13.4 and 13.5. Of the various grain and fibre crops included in the bright spots database, cotton (1.28), rice (1.29) and wheat (1.37) had the lowest increases in relative yield, whilst sorghum/millets (2.62) and maize (2.27) had the highest (Table 13.2). This may reflect (in the case of the latter crops) increased potential yields associated with improved management practices under rainfed production systems. It is widely appreciated that chronically low yields in rainfed systems represent an opportunity for significant increases in productivity. Indeed, the development of independently managed supplemental irrigation systems, along with improved soil fertility, can reduce risk and

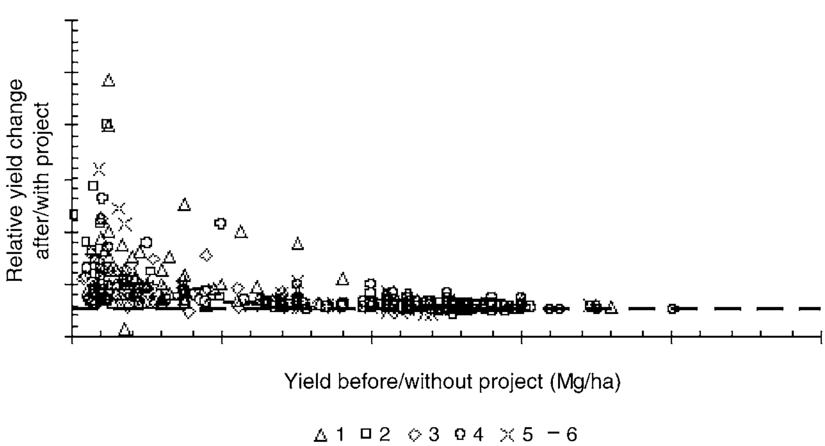

Fig. 13.4. Changes in the yields of agronomic crops with the adoption of new technologies and practices. The dataset is made up of 446 crop yields from 286 projects and the numbers represent the following crops: 1 = maize; 2 = sorghum/millets; 3 = pulse crops; 4 = rice; 5 = wheat; and 6 = cotton.

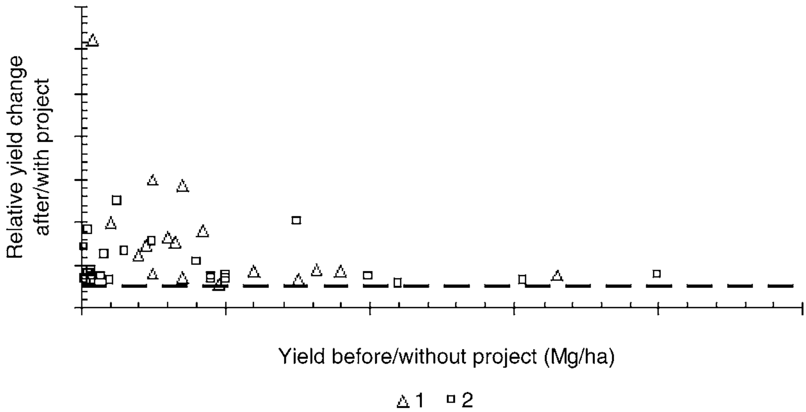

Fig. 13.5. Changes in the yields of root, vegetable and fruit crops with the adoption of new technologies and practices. The dataset is made up of 45 crop yields from 13 projects and the numbers represent the following crops: 1 = root crops; 2 = vegetables/fruit trees.

Table 13.2. Yield changes associated with the development of bright spots for different commodities. Standard error of the mean in parenthesis (adapted from Noble *et al.*, 2006; Pretty *et al.*, 2006).

Commodity	Number of observations	Mean yield before the project (mt/ha)	Mean yield after the project (mt/ha)	Relative increase in crop yield[a]
Maize	66	1.60 (± 0.17)	3.03 (± 0.28)	2.27 (± 0.18)
Sorghum/millets	23	0.63 (± 0.09)	1.36 (± 0.18)	2.62 (± 0.35)
Pulse crops[b]	35	0.83 (± 0.11)	1.53 (± 0.22)	1.89 (± 0.12)
Rice	204	4.64 (± 0.09)	5.59 (± 0.10)	1.29 (± 0.03)
Wheat	105	3.72 (± 0.11)	4.51 (± 0.10)	1.37 (± 0.07)
Root crops[c]	20	8.63 (± 1.66)	18.93 (± 2.79)	3.02 (± 0.59)
Fruit and vegetables	25	7.85 (± 2.07)	13.67 (± 3.41)	2.02 (± 0.20)
Cotton	13	1.83 (± 0.29)	2.34 (± 0.36)	1.28 (± 0.05)

[a] 1 is equivalent to yield before the implementation of the project; a value of 2 reflects a 100% improvement in productivity.
[b] Pulse crops include field peas, soybean, green gram, pigeon peas, beans and groundnuts.
[c] Root crops include potatoes, sweet potatoes and cassava.

significantly increase productivity under rainfed conditions (Rockström *et al.*, 2003).

While degradation trends at a global scale are still negative, these cases provide compelling evidence that a move towards sustainable and environmentally friendly production systems is possible and is occurring. The key priming factors that influence the development of these bright spots are investment, secure land tenure, appropriate land and water technologies, and the aspirations of individuals and communities to improve their circumstances. What is important to note is that participatory approaches alone cannot reverse degradation processes but are an important element in the drive for change.

Drivers in the Development of Bright Spots

The concept of bright spots invokes a move away from unsustainable land and water management practices through changes in people's attitudes, the adoption of cost-effective innovative practices and strategies to reverse natural resource degradation (Scherr and Yadav, 1995), as was discussed earlier. The question thus arises as to whether there are contributing elements (drivers) that influence change within individuals and communities. In a recently completed study investigating factors contributing to the development of bright spots, the importance of ten key drivers was assessed (Noble *et al.*, 2006). These comprised four distinct groups, which were associated with a range of individual drivers, namely:

Individually based drivers are those that are referred to as 'human capital' assets, commonly used in sustainable livelihoods analysis (Coleman, 1990; Costanza *et al.*, 1997; Daily, 1997; Carney, 1998; Scoones, 1998; Krishna, 2002).

- *Leadership*. Often a single individual or group (NGO or government agency) may champion change. They become a focal point in effecting change.
- *Aspiration for change*. This reflects an internal demand by an individual or community for change, which may be driven by faith or a wish to try something different.

Socially-based drivers recognize the cohesion of people in their societies and comprise relations that enhance cooperation. They incorporate the concepts of common rules, norms and sanctions with respect to behaviour in society, reciprocity and exchanges, connectedness and social institutions, which are referred to as 'social capital' (Pretty, 2001; Pretty and Smith, 2004), and the concept of participatory approaches. They include:

- *Social capital*. These are community organizations, networks and partnerships (private as well as public) that develop in order to promote change. These have the elements of bonding, bridging and linking within the community (Pretty and Smith, 2004).
- *Participatory approaches*. These are deliberative processes that actively involve the community in the decision-making process. This has a strong element of learning and teaching and involves the establishment of a partnership between farmers and the development workers.

Technically based drivers are those that are dependent on new and improved technologies and include the following:

- *Innovation and appropriate technologies*. External and internal innovations, new technologies and information are important components in change. With respect to internal innovation and appropriate technologies, this would include the revival of traditional/indigenous knowledge. External innovations (exogenous technologies) reflect new or adapted techniques (hybrids) and technologies that if adopted effect a positive change to the production system. This includes new skills and knowledge that contribute to the development of a bright spot.
- *Quick and tangible benefits*. Immediate tangible benefits to the community or individual are a prerequisite for the development of a bright spot. For example, this may include increased yields within the first year of implementing changes or a reduction in the costs of labour.
- *Low risk of failure*. Resource-poor farmers will take incremental risks that are directly related to the perceived vulnerability. Hence any change to the current status quo must have a low level of risk associated with it.

Conditions encapsulate factors that are invariably beyond the direct control or influence of the individual or community and include the following:

- *Property rights*. The element of property rights and ownership may enhance the willingness to invest in assets, thereby facilitating change.
- *Market opportunities*. If there is to be a change in practices that are contingent on the production of new or alternative crops/products, markets need to be present and assured to effect this change.
- *Supportive policies*. Changes in policies at the local, regional and national levels will facilitate the development of bright spots.

The results from an analysis of the drivers associated with the development of bright spots provide insight into the preconditions needed for their development. In general, this set of drivers was validated through the survey, in which all proposed drivers were perceived to be very important (on a scale of 1–5, with 5 as most important, all drivers received an average rating above 4), with two exceptions. Property rights received lower importance ratings overall, which reflects a characteristic inherent in the dataset, i.e. indicating that secure property rights were an initial feature in most cases. Another exception was very low importance ratings for social capital for cases in which individual adoption of a new technology was the basis of the bright spot. A more detailed analysis of the drivers associated with contrasting forms of bright spots is presented and discussed below.

An analysis of the drivers associated with the upstream cases from India, Latin America and Africa is presented in Fig. 13.6. These were primarily cases where integrated development of upper catchments areas was undertaken by community efforts. Property rights were determined to have been of a low priority in the formation of these bright spots, followed by risk and aspirations (Fig. 13.6). One could argue that the focus of upstream cases is in effecting positive changes to the community as a whole, and therefore the role of property rights in effecting change would diminish. Similarly, risk would rank low as it is equally distributed over the entire community and is not the responsibility of a single individual. In addition, leadership, participation, social and innovation drivers all ranked high as a key prerequisite of upstream bright spots development (Fig. 13.6). By aggregating the individual drivers into previously defined groupings, the important role of social factors in the development of the bright spot becomes clearly evident (Fig. 13.7), as does the low ranking of external drivers.

Contrasting with this, an assessment of the drivers associated with the adoption of a range of innovative farming practices (i.e. a technologically driven bright spot) by individual farmers in southern India and the Punjab offers insights into the factors influencing the development of bright spots that have a direct impact on the individual. These cases had a focus on introducing new technologies associated with improved rice production, integrated nutrient management, the promotion of organic farming systems (composts, biofertilizers), use of new planting material and crop husbandry techniques. The major benefactor of these initiatives was individual farmers. Regardless of the geographical distinctiveness between the two datasets, quick and tangible outcomes and innovation ranked highly (Fig. 13.8). In addition, tangible benefits and innovation associated with the development of the bright spot ranked highly. In contrast, social aspects ranked low – which reflects the individual nature of the intervention – along with property rights, as one

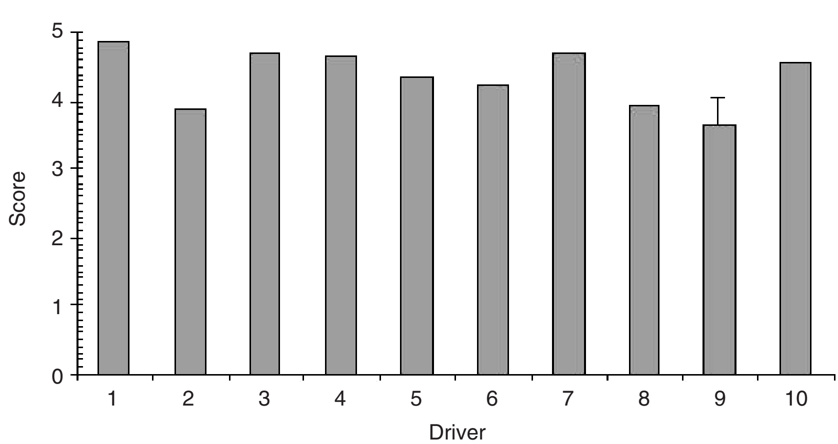

Fig. 13.6. Scores associated with individual drivers that contribute to the development of bright spots associated with upstream development (n=17) projects in India, Latin America and Africa. Vertical bar represents the least significant difference ($LSD_{0.05}$) between treatment means. The individual drivers are as follows: 1 = leadership; 2 = aspirations; 3 = social; 4 = participatory; 5 = tangible; 6 = risk; 7 = innovation; 8 = markets; 9 = property; and 10 = policy.

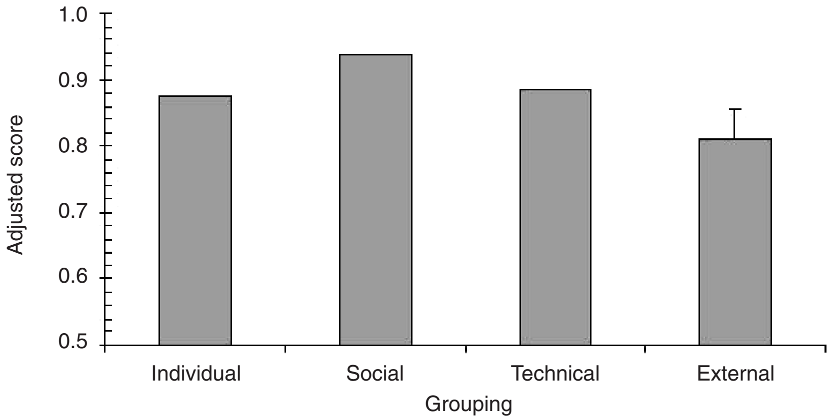

Fig. 13.7. Adjusted scores of the aggregated drivers associated with the development of bright spots of cases that focused on community-based upstream activities in India, Latin America and Africa. Vertical bar represents the least significant difference ($LSD_{0.05}$) between treatment means.

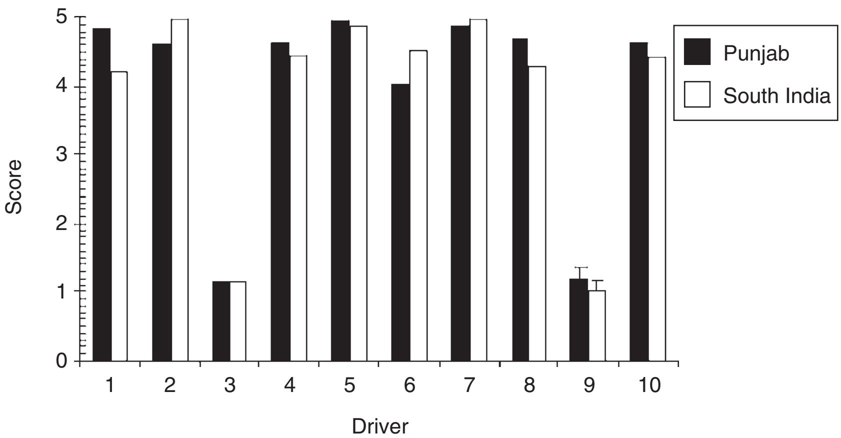

Fig. 13.8. Scores associated with individual drivers that contribute to the development of bright spots from a survey of smallholder farmers in the Punjab (n = 110) and south India (n = 94). Vertical bars represent the least significant difference ($LSD_{0.05}$) between treatment means of the same region. The individual drivers are as follows: 1 = leadership; 2 = aspirations; 3 = social; 4 = participatory; 5 = tangible; 6 = risk; 7 = innovation; 8 = markets; 9 = property; and 10 = policy.

would assume that, in the latter case, the individual adopting the improved practice would invariably own their farming unit or have access to land. In all of the cases analysed, there was an external primer that introduced the concept of the new technology for which the benefits largely accrued to the individual.

It can be concluded that drivers associated with the creation of bright spots differ significantly between target groups and the form of intervention. In the case of community-based intervention, social capital and participatory approaches are more important than external drivers, which include property rights, markets and policies. Conversely, in the development of a technologically based bright spot, the innovation needs to contain critical elements associated with quick and tangible outcomes to the adopter and have a low risk of failure. This analysis offers insight into the key elements associated with distinctly different bright spots, which may assist implementers in achieving change.

Financial Investments in Change

In the development of project-based bright spots there are invariably significant financial investments or incentives that influence the adoption of sustainable farming practices. It is therefore important to assess the contribution of such investments as it will have a direct bearing on replicability and outscaling. Although investment data are scant, almost all bright spots in the database were based on development projects, and therefore represented a certain amount of investment from international, bilateral, national government, community, NGO or other sources. Few published cases or survey respondents included a breakdown of investment, but data from ten cases in Latin America and 15 from Africa were compiled and can be summarized as follows: funds to individual projects ranged from US$3000 to US$10.5 million and from US$45,000 to US$8.9 million in Latin America and Africa, respectively. The mean investment directly impacted by the projects could be estimated at US$714/ha in Latin America, and approximately US$366/ha in Africa (Noble *et al*., 2006). These investments on a per ha basis indicate that in Latin America almost double the amount was expended in developing the bright spot when compared with Africa, suggesting that the costs associated with bright spot development in the former are considerably higher.

Discussion and Conclusions

Numerous global examples of bright spots exist that have resulted in significant impacts on individuals and communities and that go beyond the initial adopters. There is clear evidence that these bright spots are able to sustain themselves beyond the implementation stage and have a direct impact on crop productivity that would ensure household food security and potential income generation. In the majority of cases, the development of a bright spot is contingent on an external priming agent. However, cases have been reported where the development of a bright spot has not been contingent on an external priming agent, as has been observed in Uzbekistan (Noble *et al*., 2005). Invariably, this external driver facilitates the development of the bright spot through financial and non-financial contributions. In the former case, financial contributions may be significant in their development. For example, in the 17 upstream projects analysed, 13 cases provided estimates on the costs associated with their development. In this respect the total amount invested was approximately US$32 million. This form of bright spot is dependent on community mobilization and the building of social capital, which requires considerable financial input. Joshi *et al*. (2004) estimated an expenditure of US$2.5 billion on watershed development in India over the period 1951–2004. If further development and replication of a bright spot is contingent on significant financial and non-financial resources, the ability to replicate and upscale these successes will inevitably be constrained. It is important, however, to put the required investment in perspective with other types of investment in agricultural development. Without long-term production data from bright spots, it is difficult to make comparisons with investments in the construction or rehabilitation of irrigation infrastructure, owing to the extended returns that are expected from irrigation system investments. However, our sample data indicate that the bright spots investments captured here were within the same order of magnitude as irrigation system rehabilitation on a per ha basis for Asia, and less for Africa.

Whilst the analysis of these bright spots and the role of selected drivers allows for the discrimination between individual elements with respect to their importance, it does not, however, allow for an assessment of the interaction between these elements nor their importance at different times in the development process. It is recognized that no single driver, or group of drivers, contributes to the development of a bright spot, but rather a synchronized interplay between these elements occurs to effect the development. The analysis of drivers assists us to understand the key elements contributing to the development of a bright spot and provides insight into the processes that result in specific bright spots.

A common thread that links the majority of bright spots documented here is *entrepreneurship*, as defined by Schumpeter (1934). The Schumpeterian entrepreneurs are not necessarily inventors or managers or financiers – they may just as easily be those that adopt the ideas of others. Without entrepreneurship, ideas and inventions cannot impact development, sustainable or otherwise. The entrepreneur has the imagination to see the potential practical application of a technique, the initiative to actually carry out the task of introducing innovation, and the willingness to take the calculated risk that the effort might fail and lead to a loss rather than a profit (Banuri and Najam, 2002). In all of the cases studied, elements of these attributes are evident. In most of them, the form of entrepreneurship is driven specifically by the public interest, which does not necessarily seek to create a new way of generating profits but new ways of building social capital and new ways of showing how to harness existing ideas, methods, inventions, technologies, resources or management systems in the service of collective goals (Banuri and Najam 2002). Banuri and Najam (2002) make a thoughtful and appropriate analogy with sustainable development, which is pertinent to these bright spots. There are key attributes that typically define a bright spot (Kitevu *et al*. 2002). Amongst others, a bright spot should:

- Contribute to increasing potential income and result in the creation of employment for the wider community.
- Have efficient resource-utilization attributes.
- Build the capacity of individuals within the community, which enables effective technology transfer.
- Improve the health of the community and/or environmental quality.
- Improve time usage by individuals.

In addition, a bright spot should:

- Involve appropriate and sustainable technologies. Often this requires the adoption of new or innovative technologies that yield quick and tangible benefits with a low risk of failure.
- Employ local skills and resources.
- Guarantee long-term benefits associated with the community's involvement.

As indicated above, there is no blueprint for the development of a bright spot. The analysis of drivers does, however, allow us an insight into the key elements that are important in their development. The six drivers identified as a high priority in their development were: leadership, quick and tangible outcomes, supportive policy, social capital, a participatory approach with respect to the implementation of the project, and innovation and appropriate technology. Low risk of failure, the development of markets and property rights were deemed to be of a lower priority. Whilst we should treat this analysis with caution, based on the limited sample number of cases, it does give an indication of the relative importance of drivers in the development of a 'community-based' bright spot.

In 'technically based' bright spots, the beneficiary is predominantly an individual and involves the adoption of a new technology or improvements in their current farming practices. In analysing the 204 individual cases, quick and tangible outcomes are an important driver in the adoption of new innovations and appropriate technologies. This is followed by a participatory approach in implementing the technology, strong leadership by the individual or group adopting the technology, supportive policy, and markets. It is interesting to note that risk was given a significantly ($P < 0.05$) lower score than the aforementioned drivers. This could be explained on the basis that the adoption of a new technology needs to have quick and tangible outcomes, hence risk could be viewed to be low. Alternatively, it may indicate that risk aversion is not the primary concern of many of these 'entrepreneur' farmers. Social capital and property rights were also viewed as having a low priority.

Fundamental to the development, sustainability and expansion of bright spots is knowledge. This implies that there is a receptive audience that is able to access, assimilate and utilize new information in a manner that generates positive change. Far too often this is taken as a given, when in reality there are serious flaws in the level of receptiveness of the target audience, which precludes effective assimilation and utilization of new knowledge. This is a challenge that will continue to influence the success of development projects.

References

Banuri, T. and Najam A. (2002) *Civic Entrepreneurship. A Civil Society Perspective on Sustainable Development*, Vol. 1. Gandhara Academy Press, Islamabad, Pakistan.

Carney, D. (1998) Sustainable rural livelihoods. Department for International Development, London.

Coleman, J. (1990) *Foundations of Social Theory*. Havard University Press, Cambridge, Massachusetts.

Conway, G.R. (1997) *The Doubly Green Revolution*. Penguin, London.

Costanza, R., d'Arge, R., de Groot, R., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P. and van den Belt, M. (1997) The value of the world's ecosystem services and natural capital. *Nature* 387, 253.

Crissman, C.C., Antle, J.M. and Capalbo, S.M. (1998) *Economic, Environmental and Health Tradeoffs in Agriculture*. CIP, Lima and Kluwer, Boston, Massachusetts.

Critchley, W.R.S. and Brommer, M.B. (2003) Innovation and infiltration: human ingenuity in the face of water shortage in India and Kenya. Paper presented to the International Symposium on Water, Poverty and Productive Uses of Water at the Household Level, Johannesburg, South Africa, 20–24 January 2003.

Daily, G. (1997) *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, Washington, DC.

Dixon, J., Gulliver, A. and Gibbon, D. (2001) Farming systems and poverty. Food and Agriculture Organization, Rome.

Ford Runge, C., Senauer, B., Pardey, P.G. and Rosegrant, M.W. (2003) Ending hunger in our lifetime: food security and globalization. International Food Policy Research Institute. Johns Hopkins University Press, Baltimore, Maryland.

InterAcademy Council (2005) Realizing the promise and potential of African agriculture. Science and technology strategies for improving agricultural productivity and food security in Africa. InterAcademy Council, Amsterdam, the Netherlands.

Joshi, P.K., Jha, A.K., Wani, S.P., Tewari, L. and Shiyani, R.L. (2004) Meta-analysis to assess impact of watershed program and people's participation. International Crops Research Institute for the Semi-arid Tropics, Patancheru 502 324, Andhra Pradesh, India.

Kitevu, R., Kituyi, E., and Motari, M. (2002) Kenya. In: Banuri, T., Najam, A. and Odeh, N. (eds) *Civic Entrepreneurship. A Civil Society Perspective on Sustainable Development*, Vol. 2. Gandhara Academy Press, Islamabad, Pakistan, pp. 55–100.

Krishna, A. (2002) *Active Social Capital: Tracing the Roots of Development and Democracy*. Columbia University Press, New York.

Mutunga, K. and Critchley, W. (2001) Farmers' initiatives in land husbandry: promising technologies for the drier areas of East Africa. Regional Land Management Unit (RELMA), Swedish International Development Cooperation Agency (SIDA). *RELMA Technical Report Series* 27.

National Research Council (2000) *Our Common Journey*. National Academy Press, Washington, DC.

Noble, A.D., ul Hassan, M. and Kazbekov, J. (2005) 'Bright spots' in Uzbekistan, reversing land and water degradation while improving livelihoods: key developments and sustaining ingredients for transition economies of the former Soviet Union. IWMI Research Report No. 88. International Water Management Institute, Colombo, Sri Lanka.

Noble, A.D., Bossio, D.A., Penning de Vries, F.W.T., Pretty, J. and Thiyagarajan, T.M. (2006) Intensifying agricultural sustainability: an analysis of impacts and drivers in the development of 'bright spots'. Comprehensive Assessment of Water Management in Agriculture, Research Report 13, Colombo, Sri Lanka.

Norse, D., Li Ji, Jin Leshan and Zhang Zheng (2001) *Environmental Costs of Rice Production in China*. Aileen Press, Bethesda, Maryland.

Pingali, P.L. and Roger, P.A. (1995) *Impact of Pesticides on Farmers' Health and the Rice Environment*. Kluwer, Dordrecht, the Netherlands.

Pretty, J. (2001) An assets-based approach to the sustainable use of land and water. Contribution to 'Presentation on Sustainable Use of Land and Water for Food Security', Food and Agriculture Organization, Committee for Food Security, Rome.

Pretty, J.N. (2002) *Agri-Culture: Reconnecting People, Land and Nature*. Earthscan, London.

Pretty, J. and Hine, R. (2001) Reducing food poverty with sustainable agriculture: a summary of new evidence. Final report from the SAFE-World Research Project, University of Essex, Colchester, UK.

Pretty, J. and Hine, R. (2004) Measuring progress towards agricultural sustainability in developing regions. Report to DFID for project CNTR 02 4047: an analysis of findings from the University of Essex SAFE 2 Project.

Pretty, J. and Koohafkan, P. (2002) Land and agriculture: a compendium of recent sustainable development initiatives in the field of agriculture and land management. Food and Agriculture Organization, Rome.

Pretty, J.N. and Smith, D. (2004) Social capital in biodiversity conservation and management. *Conservation Biology* 18, 631–638.

Pretty, J., Brett, C., Gee, D., Hine, R., Mason, C.F., Morison, J.I.L., Raven, H., Rayment, M. and van der Bijl, G. (2000) An assessment of the total external costs of UK agriculture. *Agricultural Systems* 65, 113–136.

Pretty, J., Morison, J.I.L. and Hine, R.E. (2003) Reducing food poverty by increasing agricultural sustainability in developing countries. *Agricultural Ecosystems and the Environment* 95, 217–234.

Pretty, J., Noble, A.D., Bossio, D., Dixon, J., Hine, R.E., Penning de Vries, F.W.T. and Morison, J.I.L. (2006) Resource-conserving agriculture increases yields in developing countries. *Environmental Science and Technology* 40, 1114–1119.

Rockström, J., Barron, J. and Fox, P. (2003) Water productivity in rain-fed agriculture: challenges and opportunities for smallholder farmers in drought-prone tropical agroecosystems. In: Kijne, J.W., Barker, R. and Molden, D. (eds) *Water Productivity in Agriculture: Limits and Opportunities for Improvement.* CAB International, Cambridge, Massachusetts, pp. 145–162.

Rosegrant, M.W., Paisner, M.S., Meijer, S. and Witcover, J. (2001) Global food projections to 2020: emerging trends and alternative futures. International Food Policy Research Institute, Washington, DC.

Scherr, S.J. and Yadav, S. (1995) Land degradation in the developing world: implications for food, agriculture, and the environment. 2020 Vision, Food, Agriculture, and the Environment Discussion Paper No. 14. International Food Policy Research Institute, Washington, DC.

Schumpeter, J.A. (1934) *The Theory of Economic Development: an Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. Harvard University Press, Cambridge, Massachusetts.

Scoones, I. (1998) Sustainable rural livelihoods: a framework for analysis. IDS Discussion Paper, 72. Institute of Development Studies, University of Sussex, Falmer, Brighton, UK.

Tegtmeier, E.M. and Duffy, M.D. (2004) External costs of agricultural production in the United States. *International Journal of Agricultural Sustainability* 2, 1–20.

UNFPA (2004) *State of the World Population 2004. The Cairo Consensus at Ten: Population, Reproductive Health and the Global Effort to End Poverty*. United Nations Population Fund, New York.

Uphoff, N. (2002) *Agroecological Innovations: Increasing Food Production with Participatory Development*. Earthscan, London.