COMPREHENSIVE Assessment of water management in agriculture

Research Report 13

Intensifying Agricultural Sustainability: An Analysis of Impacts and Drivers in the Development of 'Bright Spots'

A. D. Noble, D. A. Bossio, F. W. T. Penning de Vries, J. Pretty and T. M. Thiyagarajan

IWMI International Water Management Institute

University of Essex

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Comprehensive Assessment of Water Management in Agriculture

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The authors: A.D. Noble, Principal Research Scientist, International Water Management Institute, c/o WorldFish Centre, P O Box 500 GPO, 10670, Penang, Malaysia; D.A. Bossio, Theme Leader and Principal Research Scientist, International Water Management Institute, Colombo, Sri Lanka; F.W.T. Penning de Vries, Director, Monsoon Asia Integrated Regional Study, Institute for Atmospheric Physics, Beijing PR China; J. Pretty,Professor and Head, Centre for Environment and Society and Department of Biological Sciences, University of Essex, Colchester UK; and T.M. Thiyagarajan, Professor and Director, Agricultural College and Research Institute, Killikulam, Vallanadu 628252, Thoothukudi District, Tamil Nadu, India.

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Cover photograph by Andrew Noble shows mixed farming systems in the Don Cao catchment of northern Vietnam.

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Summary

If food security is to be obtained for a growing global population while maintaining environmental integrity, substantial increases in land and water productivity are necessary. Such increases will need to be gained against a background of continued water and land degradation arising as a result of the continued expansion of industrial agricultural activity and exploitive subsistence production systems. 'Bright Spots' are examples of interventions, which have successfully reversed the continuing downward spiral of poverty, and which reveal positive impacts on land and water resources. 'Bright Spots' are usually typified by individuals and communities that have adopted simple innovations to their production systems. Farmers have benefited twofold by these simple innovations: (i) incomes being increased; and, (ii) food security at the household level is enhanced.

The objectives of this study were to assess the extent and impact of 'Bright Spot' development on a global basis drawing on data sets developed during the course of the project and other research, and to determine whether there are important replicable drivers that contribute to the development of 'Bright Spots'.

'Bright Spots' embody agricultural sustainability, producing food by making use of ecological goods and services, without permanently damaging these assets. In an analysis of 286 cases from 57 countries, the impact of 'Bright Spots' development influenced 10.9 million households covering an area of 31.6 million hectares. The development of 'Bright Spots' is based upon a wide variety of innovative technologies and practices that yield a series of benefits, including enhanced agricultural productivity, improved soil health and fertility, more efficient use of water (under both rain-fed and irrigated farming systems), and increases to infield biodiversity through improved pest and weed management. In addition, the adoption of these technologies and practices resulted in crop yields having an average weighted increase of 156 percent over all other farming systems. Out of the different types of commodities included in the 'Bright Spots' database, cotton (30%), rice (30%) and wheat (38%) had the lowest increases in yield. The highest increases in yield were for sorghum/millets (134%) and maize (120 %.). Overall, the most significant increases in yield were found in Africa (257%), but gains in Asia and the Pacific (132%) and Latin America (161%) also were impressive.

While degradation trends at a global scale are still negative, the 'Bright Spots' examples provide compelling evidence that a move towards sustainable and environmentally-friendly production systems is possible and is occurring. The key factors that influence the development of these 'Bright Spots' are: (a) investment in appropriate land and water technologies; (b) the aspirations of individuals (leadership) and communities to improve their circumstances; and (c) entrepreneurship. It is important to note that participatory approaches alone cannot reverse degradation processes, but are an integral element in the drive for change.

While there is no single blueprint for the development of a 'Bright Spot', the analysis of drivers does yield insights into the elements important to their development. An analysis of ten main drivers associated with the development of these 'Bright Spots' revealed that, on a global scale, quick and tangible outcomes from the adoption of a new technology or changes to

farming practices and technological innovation were both ranked highest out of the group of drivers. Social capacity and property rights both scored significantly lower than all other drivers with scores of 1.79 and 1.53, respectively, on a scale of 1–5. This may in part be attributed to the fact that the majority of the cases focused on enhancing productivity at the field level, where social capital plays a lesser role. In addition, property rights gained lower ratings given that most of the cases studied were among individuals and communities with access to land.

A further breakdown of cases into types based on the level of social organization required for their implementation (individual adoption of improved technology; small-scale irrigation development requiring both community and individual action; and community cases of watershed development) reveals some differences in the degree of importance each of these drivers has in the development of 'Bright Spots'. Community-based 'Bright Spots' are those that have a focus on collective mobilization. Six high priority drivers were identified for this type of 'Bright Spot': (1) leadership; (2) quick and tangible outcomes; (3) supportive policy; (4) social capital; (5) a participatory approach with respect to the implementation of the project; and (6) innovation and appropriate technology. Low risk of failure, the development of markets and property rights were deemed to be of a lower priority. Individually-based 'Bright Spots' are those where the actor and benefactor are predominantly the individual, and involved the adoption of a new technology or improvements to their current farming practices. In these cases, the most important drivers were related to technology characteristics, for example, quick and tangible outcomes, innovativeness; and individual characteristics such as aspiration for change. This was followed by a participatory approach in implementing the technology, namely strong leadership by the individual adopting the technology; supportive policy; and access to markets.

An assessment of the financial investment for selective cases in Africa and Latin America estimated the effective cost per hectare of land influenced by 'Bright Spots' development. In Latin America, investments were estimated to be US$997/ha (within a range of US$1.2–US$25,000 per ha). Notably, contributions from National Governments in these cases amounted to US$5.5 million—18 percent of the total value of investments. In other words, for every US$1 sourced from National Governments, US$5.48 was derived from other sources. Similarly for every US$1 sourced from National Government coffers in Africa resulted in the existing equivalent US$14.22 derived from other sources. This survey estimated that investments averaged US$354 for every hectare of land that was improved, approximately half of that was invested in the Latin American cases collected in this survey.

Lying at the heart of 'Bright Spots' development is new knowledge and its adoption. In addition, 'Bright Spots' require innovations that yield positive change. Knowledge and innovation together imply entrepreneurial capacity. As such, this report argues that promoting entrepreneurship may be a key element in the expansion of 'Bright Spots'.

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Introduction

A critical challenge facing the global community over the coming two decades is providing adequate levels of nutrition and opportunities for wealth creation in marginalized and disadvantaged communities. A wide variety of doomsday stories 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 (Pretty and Koohafkan 2002). These alarming trends and the increased incidence of drought associated with climatic variability, outbreaks of pest (i.e., locust plagues in Africa and Australasia), and diseases (i.e., avairian flu in Southeast Asia and North Asia) contribute to heightened food shortages and the risk of famine. These factors all cast doubt on the capacity of global agriculture to provide sufficient, reliable and safe food supplies to an ever-increasing world population.

Land and water degradation pose a serious threat to food security, livelihoods and the well-being of rural populations that occupy these degradation-prone marginal lands. This issue is of particular relevance in countries where expansion of agriculture through exploitation of new land and water resources has reached its zenith. There are isolated examples around the globe of interventions that have been effective in reversing the continuing downward spiral of poverty and hopelessness, thereby creating positive impacts on land and water resources. These are often termed 'Bright Spots' in the published literature and are characterized by individuals or communities that have made changes, which have led to a reversal of land and water degradation (Scherr 1999). These 'Bright Spots' can be defined as individuals and small communities (households) who have adopted innovative practices and strategies to reverse natural resource degradation in a sustainable manner. Hence, maintain or enhance food security. 'Bright Spots' are potentially sustainable, and levels of natural resource capital are above ecological and economic thresholds.

Kitevu et al. (2002) provide a more complete description of the attributes that define a 'Bright Spot':

The 'Bright Spot' should contribute to:

- Increasing potential income and result in the creation of employment for the wider community;
- Have the attributes of efficient resource utilization;
- The building of capacity within the community or individuals that enables effective technology transfer;
- Improved health of the community and environmental quality; and
- Improvements in time management by individuals.

In addition a 'Bright Spot' should:

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

Industrialized agricultural production systems have been extremely successful in maintaining food supplies to a burgeoning global population over the past two decades. The success of these systems, however, has been at a cost to both 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 as evidenced in recent publications that include examples from Ecuador, China, Germany, the Philippines, UK and the USA (Crissman et al. 1998; Norse et al. 2001; Waibel et al. 1997; Pingali and Roger 1995; Pretty et al. 2000; Tegtmeier and Duffy 2004). There is a growing concern that these highly industrialized production systems may not alleviate food poverty. Resource-poor farmers require low-cost and readily-available technologies and practices to increase food production, thereby enhance their incomes (Pretty et al. 2006).

There are numerous documented examples and case studies that have been undertaken, where individuals or communities have made changes that have significantly enhanced their livelihoods and well-being, while having positive impacts on resource sustainability (Pretty 2001; Pretty and Hine 2000; Pretty et al. 2003; Critchley and Brommer, 2003; Banuri et al. 2002). These individuals and communities have adopted simple non-exploitive innovations to their production systems, which have contributed significantly towards ensuring food security at the household level and increased incomes. These can be termed 'Bright Spots' and effectively reflect a sense of cautious optimism, in that, there is an adoption of sustainable farming practices that result in enhanced livelihoods and positive impacts on the environment.

In evaluating these successes the question arises as to whether there are key factors that are fundamental in the development of these 'Bright Spots'? If so, can these be developed into guidelines that would enhance up-scaling and increase food security and household incomes? In this study we try to address these questions through the analysis of survey data on important drivers, which are associated with the development and continuance of selected 'Bright Spots'.

The objectives of this study were as follows:

1. Assess the extent and impact of 'Bright Spots' on a global basis using data sets captured through the current project and previously collected data.
2. Determine whether there are generic drivers that contribute to the development of 'Bright Spots' and whether they could assist in the further expansion and up-scaling of 'Bright Spots'.

The first part of the report evaluates global and continental impacts of 'Bright Spots' on crop productivity. This is followed by a discussion of the key drivers associated with the development of these 'Bright Spots' and a brief assessment of financial investments associated with the development of these successes. The report concludes with an overall discussion of 'Bright Spots' and examines the potential for their up-scaling.

Box 1. Developing A Grape Production Enterprise in Northeast Thailand: An Individual's Initiative to Diversify

A. D. Noble, IWMI-SEA, Penang, Malayasia.

Photograph by Andrew Noble

A farmer from Northeast Thailand shows off his table grape enterprise that he has developed with his wife through the conversion of a small portion of their rice farm.

A farmer and his wife in the Sakon Nakon area of Northeast Thailand have over the past 2 years established a grape orchard on a 0.8-hectare plot of land. The total extent of the family farm is 8 hectares, of which the remaining 7.2 hectares are leased out to 'share croppers' who grow rice on it. Thirty percent of the rice-yield is given to the farmer as compensation for the land. The family unit consists of five children and the parents. What is unique about this farm is that, it has not been subdivided among the children, which is contrary to the common practice of these rural communities. Hence, the integrity of the original farm has not been compromised. 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 behind their brother, parents and the current (tenant) farmer and his wife, on the farm. The farmer is young and well educated. Having completed school he undertook training in business administration. On completion of his formal education he worked in a manufacturing company, where he acquired practical skills in mechanics and metal working. On returning to the farm, he decided to undertake a study tour to determine possible alternative options for the farm, all of which were funded from his own resources. He decided that grape cultivation was a viable option for the area, as there were no other farmers in the area growing such a crop. A study tour to southern grape-growing areas of Thailand resulted in him acquiring skills in trellising and the cultivation of grapes, along with planting material for his farm. Using micro-jet irrigation, he and his wife have established the orchard that is now coming into production. There has been a substantial investment (US$12,500) in the project, the funds coming from household savings. The harvested grapes are sold at the farm gate to buyers and, as such, no marketing of the product is required. The farmer expects to make significant profits within the next 2 years. The fact that he has undertaken this development of the farm, considering his lack of experience in viticulture (grape-growing), clearly indicates his positive approach to taking risks. When questioned whether he would expand his grape-growing activities further once the vines were in full production, he was emphatic that he would not expand current operations since it would require employing additional labor. This would affect his profit margin. An important characteristic of this viticulture operation is that, it keeps both the farmer and his wife actively engaged in the process throughout the year. The majority of farmers in the area are confined to growing a single crop of rice, which effectively employs them burgeoning only for 6 months of the year. As a result, out-migration of significance occurs during the off season, with farmers moving to Bangkok for employment on either construction sites or driving taxis. The success of this 'Bright Spot' is based on the individual being highly motivated as well as having acquired significant skills and, more importantly having financial capital to invest in the development of the venture. Although this is a 'Bright Spot' it is highly unlikely that it could be replicated due to the lack of skills within the general community on viticulture, and the high capital investment required.

Methodology

Assessing the Extent and Impact of 'Bright Spots'

The project adopted a three-stage approach in the assessment of the key drivers associated with the development of 'Bright Spots', along with the quantification of their impact. The three stages included:

1. A collation of new surveys and published data that capture the positive impact of 'Bright Spots', including the increase of crop yield, extent of impact of the project i.e., the number of householders or farmers adopting improved practices, and number of hectares affected. Sources included original surveys, case studies in both the public domain and grey literature, and data captured in the SAFE-World (Sustainable Agriculture to Feed the World – referred to as SAFE) database of the University of Essex (Pretty et al. 2003; Pretty, 2001; Pretty and Hine, 2000). The SAFE database assessed the global extent of 'Bright Spots' that are predominantly based on sustainable organic systems with limited reliance on fossil-fuel derived inputs.
2. A survey of proposed drivers investigated the factors that have led to the development of 'Bright Spots'. The questionnaire contained opportunities for the respondents to provide information on productivity increases that accrued through the adoption of improved sustainable practices and the degree of adoption, contributing to impact assessment, and the role of key drivers in effecting change (see annex 1).
3. A limited number of in-depth case studies were undertaken to evaluate drivers for the development of 'Bright Spots'. Detailed discussion of these studies are published elsewhere (D'Silva and Nagnath 2005; Sreedevi et al. 2004; Joshi et al. 2005).

In evaluating the drivers associated with the development of 'Bright Spots', ten key elements were identified as being of significant importance. These elements were identified through a consultative process with researchers working in this area of development, at a workshop conducted in Bangkok in February 2003. The participants in the workshop were from South and Central Asia, Southeast Asia, Africa, Latin and Central America and Europe. The ten key elements in the four major categories were as follows:

Individually-based Drivers

These individually-based drivers are referred to as 'human capital' assets commonly used in sustainable livelihoods analysis (Coleman 1990; Costanza et al. 1997; Carney 1998; Pretty 1998; Scoones 1998; Pretty and Ward 2001; Krishna 2002). In the current study of drivers these include:

Leadership. Often a single individual or group (NGO or government agency) may become the champion for change. They become the focal point in effecting change and are critical in effecting change.

Aspiration for Change. This reflects an internal demand by an individual or community for change that may be driven by faith or a wish to try something different. In addition, it reflects an innate appreciation by the individual or community of their current predicament and that there are ways of improving the situation.

Socially-based Drivers

These recognize the cohesiveness of people in their societies and comprise relations that enhance cooperation; it incorporates the concepts of common rules, norms and sanctions with respect to behavior in society; reciprocity and exchanges (Pretty 2001; Pretty and Smith 2004). 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 Approach. 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

Technically-based drivers reflect new technologies or knowledge that is introduced to enhance the performance and the sustainability of production systems. These 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/local knowledge. External innovations reflect new developments in techniques 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; a reduction in the costs of labor etc.

Low Risk of Failure. Resource-poor farmers by their very nature are risk-averse and, as such, any change to the current *status quo* must have a low-level of risk associated with it.

Externally-based Drivers

These 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 individual property rights and ownership may enhance the willingness of individuals to invest in land and water resources and its conservation, thereby facilitating change.

Market Opportunities. If there is to be a change in practices that are contingent on the production of a new or alternative crops/products, economic markets need to be present and assured to effect this change.

An outcome of these deliberations was the development of a three-page survey questionnaire. The questionnaire addressed the key impacts of the 'Bright Spot' such as intervention on total food production and its impact on natural resources; the degree of up-take and scaling-up associated with the intervention; and the relevance of the key elements in the development and continuance of the 'Bright Spot' (see annex 1). The questionnaire endeavored to quantify the role that an intervention had on enhancing productivity and associated natural assets, along with determining the relative importance of key elements in effecting change and its continuance. The respondents were individuals involved in the project such as project implementers, village leaders and farmers. The questionnaires were filled in either by the respondent or through enumerators that interviewed the respondents. For the drivers analysis respondents were asked to indicate the importance of the ten drivers on a scale of 1–5, with 5 being the highest or most important.

All of the questionnaires, which were duly filled and returned, along with any other secondary material collected within the public domain and grey literature, were individually added to a database. Each of the questionnaires returned was checked to identify gaps and ambiguities. Those questionnaires that were deemed untrustworthy were rejected. It should be noted that the questionnaire was self-completed by either individuals who were intimately involved in the case/project or through interviews with enumerators (i.e., India data sets from South India and the Punjab). In both cases, however, there is the potential for possible bias. Within the database each questionnaire was

classified into the major farming systems as defined by Dixon et al. (2001). The typology of farming systems developed by the Food and Agriculture Organization (FAO) for the World Bank (WB) was used to classify these projects into eight broad categories. These were based on the following social, economic and biophysical criteria:

- The available natural resource base, including water, land, grazing areas and forest; climate and altitude; landscape, including slope; farm size, tenure and organisations; and access to services including markets.
- The dominant patterns of farm activities and household livelihoods, including field crops, livestock, trees, aquaculture, hunting and gathering, processing and off-farm activities; and the main technologies used, which determine the intensity of production and integration of crops, livestock and other activities.

The eight broad-based farming systems were as follows:

1. Smallholder irrigated farming systems —includes a broad range of food and cash crop production systems.
2. Wetland rice-based farming systems —predominantly dependent on monsoonal rains with supplemental irrigation.
3. Rain-fed farming systems in humid and subhumid areas—characterized by crop activities that include any or a combination of the following crops: root crops, cereals, industrial tree crops (both small and plantation), and commercial horticulture or mixed crop-livestock systems.
4. Rain-fed farming systems in steep and highland areas—often mixed crop-livestock systems.
5. Rain-fed farming systems in dry or cold areas—mixed crop-livestock and pastoral systems merging into sparse and often dispersed systems with very low productivity or potential due to extremes of aridity or cold.
6. Dualistic farming systems with both large-scale commercial and smallholder farms—across a variety of ecologies and with diverse production patterns.
7. Coastal artisanal fishing mixed farming systems—often mixed farming systems.
8. Urban-based farming systems—typically focused on horticultural and livestock production.

Within these 8 major farming systems, a total of 72 specific farming systems were identified, some of which comprised similar systems occurring on different continents (Dixon et al. 2001).

Data Analysis

In the analysis of the data, an initial global assessment of overall impact, extent and adoption of ‘Bright Spots’ was undertaken. This assessment was further disaggregated on a continental basis, where individual analyses were undertaken on impact in Latin America, Africa and Asia. In addition, an analysis of drivers was done for the global dataset. And, finally, an analysis of the drivers was undertaken based on the typology of the ‘Bright Spot’ cases. For this analysis, ‘Bright Spots’ cases were grouped into three categories, which were based on the degree of social organization required for their implementation. The three categories were:

- individual adoption, representing uptake of improved technology by individuals, with little dependence on community action;

- intermediate adoption, represented by small-scale irrigation development requiring both community and individual action; and
- community action, including cases of watershed development, which were primarily based on organization at the community level.

Simple descriptive statistics as well as an analysis of variance (ANOVA) were employed in the assessment of statistical significance between variable means.

Box 2. Africa Centre for Holistic Management

Dr. Constance Neely, 1160, Twelve Oaks Circle, Watkinsville, GA 30677, USA.

The Wange Community of Northwest Zimbabwe typify most of the problems that plague rural communities in Africa, namely desertification of land, the drying up of rivers, boreholes and dams, approximately 80,000 people in poverty, rampant AIDS, constantly failing crops, dwindling livestock, the exodus of young people, severe 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 initiative, 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 associated symptoms such as droughts, floods, poverty, social breakdown, violence, abuse of women and children, etc. These achievements are envisaged by empowering people to take charge of their lives and destiny, including the usage of a holistic decision-making framework that was developed by the Zimbabwean founder of this project.

The overall achievement of the project to date is that, it has been identified as an 'island of calm' in the chaos of today's Zimbabwe. There have been over 2,000 village members trained through the conservation projects (grazing, home gardens, women's banks, and wildlife management). War veterans are being trained as Game Scouts and are actively engaged in apprehending poachers while sharing income from organized wildlife safari hunting. All the Chiefs of the vast Wange Communal Lands are Trustees and devote significant time and energy to the 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. Hence enabling the Africa Centre to form a College of Agriculture and a center for Wildlife and Conservation Management. The total land now managed by the Africa Centre amounts to 8,080 hectares. This land, held by the Trustees for the good of the community, is dramatically improving with vast increases in ground cover, abundance of grass for farm animals and wildlife, and an increase of water in boreholes. With one of its main rivers close to becoming perennial in flow once more, the amount of wildlife on the project land has increased tenfold or more.

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 made to establish a monitoring program to formally capture the gains being made socially, environmentally and economically in the community, in a comprehensive manner. Due to the holistic grazing planning implemented by the Africa Centre on their land, a substantial number of the community's livestock was saved from extermination during the 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 to date is manifested in 8,080 ha of land, which is but a small percentage of the over 404,000 ha of the Wange communal lands. Nevertheless, it is their model 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.

There are now approximately 500 women participating in the Africa Center's women's micro-lending banks. The banks are in their fourth year of operation and continue to maintain 100 percent payback rate, with most women reporting significant and encouraging changes in their households 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 annually to develop the community. Over 40 ha of improved small gardens as well as gardens utilizing drip-irrigation kits have been established. Establishing deep trust and acceptance with the community takes time and patience. The process must be driven by local people and they should realize that developing a team of community leaders with commendable commitment and required skills takes time.

Results and Discussion

Global Extent of 'Bright Spots' and Productivity Increases

The concept of a 'Bright Spot' in the current context encapsulates agricultural sustainability, here defined as food production that makes preeminent use of nature's goods and services while not permanently damaging these assets (Pretty et al. 2006). There are other forms of 'Bright Spots', which have their focus on civic entrepreneurship (Banuri et al. 2002). These have a direct impact on the livelihoods and well-being of millions of people who do not have an agricultural basis, and are just as important and effective in addressing the plight of marginal disadvantaged individuals or communities. However, these other forms of 'Bright Spots' are not considered in this study although they are deemed to be equally important.

Data sets collected from the current survey, and those collected from the SAFE projects of Pretty and Hine (2001, 2004), were combined in order to assess the global extent and impact of 'Bright Spots' from an areal and population perspective. 'Bright Spots' were categorized into the eight main farming systems as defined by Dixon et al. (2001).

The database comprises 438 cases from 57 countries. The impact of these 'Bright Spots' influenced 10.9 million households, covering an area of 31.6 million hectares (table 1). The largest number of farmers adopting improved

TABLE 1.
Summary of Global adoption and impact of sustainable agricultural technologies and practices on 438 projects in 57 countries. Values in parenthesis are the Standard Deviation from the Mean.

FAO farm system category[1]	Number of farmers adopting	Number of hectares under sustainable agriculture	Average % increase in crop yields[2]	
1. Smallholder irrigated	172,389	357,296	169.8	(±197.2)
2. Wetland rice	7,226,414	4,986,284	21.9	(±32.3)
3. Smallholder rain-fed humid	1,708,278	1,122,840	129.3	(±167.3)
4. Smallholder rain-fed highland	387,265	702,313	112.3	(±122.3)
5. Smallholder rain-fed dry/cold	579,413	719,820	98.6	(±95.3)
6. Dualistic mixed[3]	466,292	23,515,847	55.3	(±32.4)
7. Coastal artisanal	220,000	160,000	62.0	(±28.3)
8. Urban-based and kitchen garden	206,492	35,952	158.8	(±98.6)
[4]Total/weighed mean for all projects	10,966,543	31,600,352	156.4	

Notes: Author's creation

[1] Based the farming systems classification of Dixon et al., 2001

[2] Yield data reported as the % increase in yield from levels before the inititiation of the project

[3] Dualistic refers to mixed large commercial and smallholder farming systems, mainly from southern Latin America

[4] Weighed mean is based on the area occupied by each of the farming systems and is calculated as follows:
Σ (S_i x A_i)/Σ A_i where S_i is the average yield increase for system i ; A_i is the area occupied by S_i

management strategies was from the wetland rice-based systems, predominantly in Asia. And the largest area influenced by the interventions was in a dualistic mixed farming system, predominantly in southern Latin America (table 1). In the latter case this comprises the adoption of conservation 'no tillage' agriculture practices in Santa Catarina, Brazil. The total area of 31.6 million hectares that is in transition towards a sustainable agricultural production system captured in this data base represents 2.3 percent of the total global cultivated area (i.e., estimated to be 1,136 million hectares (Dixon et al. 2001)). The number of cases assessed in this analysis is by no means exhaustive and is limited to the data captured in this study and those obtained through the SAFE surveys. They, therefore, represent a fraction of the total number of global 'Bright Spots'. There is, therefore, cause for cautious optimism as there is clear evidence of farmers adopting improved sustainable production practices, and that they have a positive impact on their food security at the household level, improvement of livelihoods (increased income) as well as accruing tangible benefits to the environment as a whole. Indeed, the potential benefits associated with the adoption of sustainable farming systems on carbon sequestration and water productivity have been shown to be significant (Pretty et al. 2002; Pretty et al. 2006). Clearly, these positive environmental and financial benefits that would accrue through the development of a 'Bright Spot' lie beyond the 'farm gate' and would be significantly greater than what is covered in this analysis.

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

- Intensification of a component of the farming system, such as the development of home gardens for vegetable and fruit production, the introduction of fish into farm ponds or the adoption of dairy cattle.
- The incorporation of new productive elements into the farming system that could include the introduction of fish or shrimps into rice fields, or the incorporation of tree crops which provide an increase to total farm production and incomes. These represent a

diversification of the farming enterprise, which can minimize the risk-exposure linked with market fluctuations (a common factor related to single-commodity-based enterprises).

- Better use of natural resources to increase total farm production e.g., water harvesting, land reclamation and rehabilitation.
- Improvements in per hectare yields of staple cereals through the introduction of new regenerative elements into the farm system such as legumes, integrated pest management, new and locally-appropriate crop varieties and animal breeds, and the adoption of new technologies.

What is important in all of these cases is that, a wide range of technologies and practices were used to enhance productivity, which also improved soil health and fertility, facilitated more efficient water use under rain-fed and irrigated farming systems, and effected an increase in infield biodiversity through improved pest and weed management. The development of a 'Bright Spot' through the adoption of sustainable agricultural production systems may result in improved domestic food consumption or an increase in sales through home gardens or fish in rice field, or better water management without necessarily affecting the per hectare yields of cereals (Pretty and Hine 2004).

Associated with the adoption of these technologies and practices average weighted increases, which takes into account the average yield increases and the area established for each farming system, was 156.4 percent (table 1). However, the degree of improvements in yields as indicated in figures 1 and 2 was widespread. Of the various commodities included in the 'Bright Spots' database: cotton (30%), rice (30%) and wheat (38%) had the lowest increases in relative yield. The highest increases in relative yield were for sorghum/millets (134%) and maize (120%) under rain-fed conditions, see (table 2). This may reflect as in the case of the latter that the increase in potential crop yields is associated with improved management practices under rain-fed production systems. Indeed, the development of independently-managed supplemental irrigation systems, along with improved soil fertility can reduce risk of drought and significantly increase productivity under rain-fed 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.

TABLE 2.
Yield changes associated with the development of 'Bright' spots for different commodities on a Global basis. Standard Error of the Mean in parenthesis.

Commodity	Number of observations	Mean yield before the project (t ha^{-1})	Mean yield after the project(t ha^{-1})	Relative increase in crop yield[1]
Maize	66	1.60 (±0.17)	3.03 (±0.28)	120.7 (±17.1)
Sorghum/millets	23	0.63 (±0.09)	1.36 (±0.18)	134.1 (±29.2)
Pulse crops[2]	35	0.83 (±0.11)	1.53 (±0.22)	88.8 (±12.1)
Rice	204	4.64 (±0.09)	5.59 (±0.10)	30.3 (±3.5)
Wheat	105	3.72 (±0.11)	4.51 (±0.10)	38.0 (±7.1)
Root crops[3]	20	8.63 (±1.66)	18.93 (±2.79)	183.9 (±55.0)
Fruit and vegetables	25	7.85 (±2.07)	13.67 (±3.41)	95.4 (±17.6)
Cotton	13	1.83 (±0.29)	2.34 (±0.36)	29.6 (±5.5)

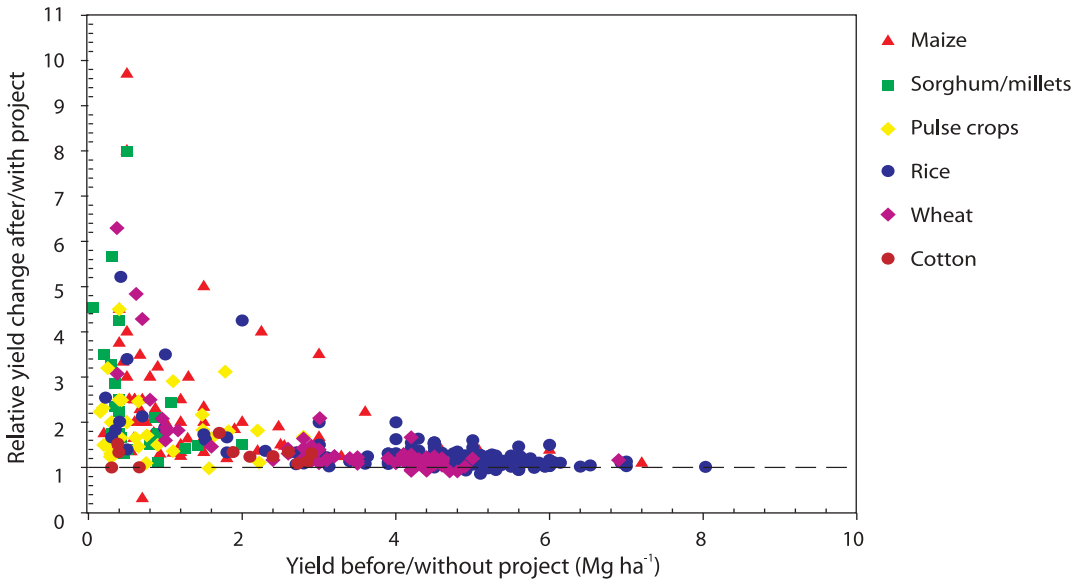
Notes: Author's creation

[1] Relative increase in crop yields is equivalent to yield before the implementation of the project a value of 2 reflects a 100% improvement in productivity

[2] Pulse crops include field peas, soybean, green gram, pigeon peas, beans and groundnuts

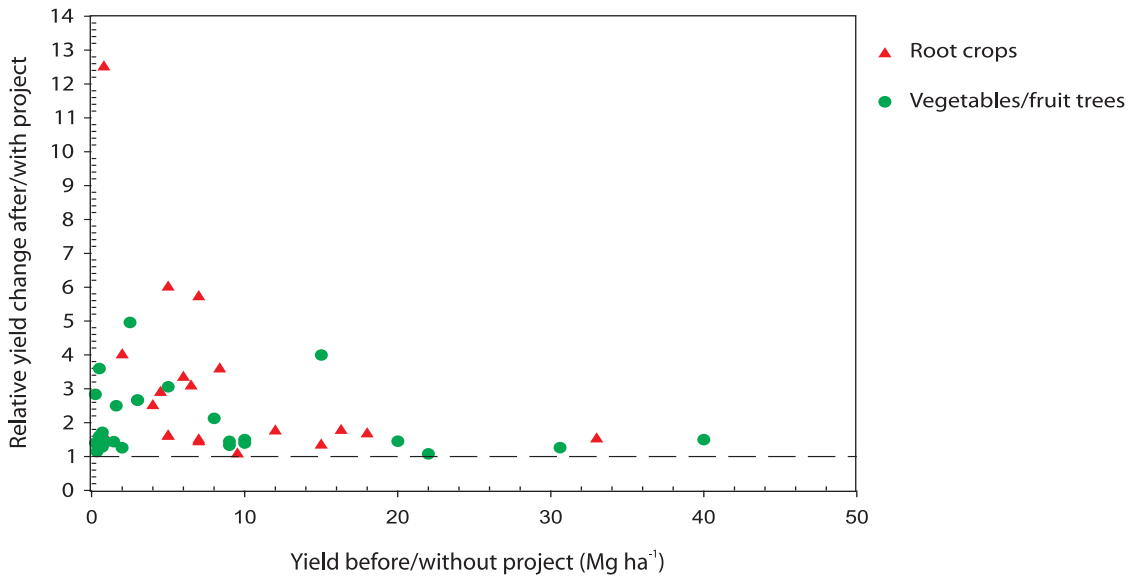
[3] Root crops include potatoes, sweet potatoes, and cassava

FIGURE 1.
Changes in the yields of agronomic crops with the adoption of new technologies and practices on a Global basis. The data set is made up of 446 crop yields from 286 projects. Dashed line indicates no change in relative yield.



Note: Author's creation

FIGURE 2.
Changes in the yields of root, vegetable and fruit crops with the adoption of new technologies and practices on a global basis. The data set is made up of 45 crop yields from 13 projects. Dashed line represents no change in relative yield.



Note: Author's creation

Assessment of Productivity Increases on a Continental Basis Associated with 'Bright Spot' Development

In the following section, an analysis of the impact of 'Bright Spots' is made on a continental basis. This is followed by an assessment of the impact of these interventions on the productivity of selected crop varieties.

A total of 110 African cases contained sufficient information to estimate the extent and impact of 'Bright Spots' in Africa. These 'Bright Spots' sustained 4.6 persons per hectare with a range of 0.2 to 13.1 persons per hectare on average. In total, 1.79 million farmers on 1.91 million hectares have adopted improved land and water management strategies that have had a significant impact on the crop yield and the environment (table 3). In Africa, the largest number of farmers impacted through the development of 'Bright Spots' was under rain-fed humid systems, followed by smallholder irrigated schemes (table 3). Wetland rice-based, dualistic mixed-farming systems and coastal artisanal fishing were under- represented in the cases collected.

Sub-Saharan Africa contains a total population of 629 million people, of which 384 million are classified as agriculturalists (Dixon et al. 2001). The total area under cultivation or with permanent crops is estimated to be 173 million hectares (FAOSTAT 2003). While the number of cases assessed in this analysis is by no means exhaustive and is limited to data captured in the aforementioned databases, they are likely representative of a small fraction of the total number of 'Bright Spots' that exist in Africa. The direct extent of impact of these 'Bright Spots' from a total area and population perspective is 1 percent and 0.5 percent, respectively.

In contrast to Africa, wetland rice farming systems dominated the Asia and the Pacific region cases with over 7.2 million farmers out of a total of 8.3 million farmers being impacted by the development of 'Bright Spots', which reflects the importance of this commodity in the region (table 3). However, it should be noted that smallholder irrigation and coastal artisanal were under-represented. The total number of cases assessed was 272. The majority of them was from South Asia and involved the adoption of improved regenerative technologies in the growing of rice, which included the adoption of rice/wheat cropping systems. While this region had the largest number of cases, the hectares per farmer adopting the 'Bright Spot' was low, a mere 0.72 ha/farmer as compared to 1.06 ha/farmer for Africa.

Of all the regions, Latin America had the smallest number of cases (55), although the area impacted through the development of 'Bright Spots' was the largest (table 3). The dualistic farming systems had the largest areal and farmer impact, but smallholder irrigation and wetland rice were under-represented. In the dualistic farming systems, cases dominated by extensive livestock production in combination with the adoption of minimum or zero tillage on highly mechanized farming enterprises accounted for the large area impacted upon (table 3). The number of hectares per farmer adopting was the highest for all continents (29.26 ha/farmer) reflecting the extensive nature of farming operations and larger farm size when compared to Asia and the Pacific, where more intensive and smaller farming units are the norm.

Crop Yield Responses on a Continental Basis

There was a weighed yield increase of 256.6 percent for African cases on average (associated with the implementation of the project), which indicates the dramatic effect of these interventions on crop productivity (table 3). It should be noted that Africa had the highest degree of variability in yield increases within each of the farming systems, which is evidenced by the large standard deviations from the mean (see table 3). Asia and the Pacific and Latin America had weighed mean yield increases of 132.0

TABLE 3.

Extent of impact and adoption of 'Bright' spot based on the data from the SAFE-World database (Pretty and Hines 2001) and Noble et al. (2004) and categories according to Dixon et al. (2001) farming systems in the Africa, Asia and Pacific, and Latin America. Values in parenthesis are the standard deviation from the mean.

FAO farm system category[1]	Number of farmers adopting	Number of hectares under sustainable agriculture	Average % increase in crop yields[2]
Africa (n* = 110)			
1. Smallholder irrigated	172,389	357,296	174.9 (±201.8)
2. Wetland rice	-	-	-
3. Smallholder rain-fed humid	1,426,957	875,260	133.0 (±182.4)
4. Smallholder rain-fed highland	104,906	518,804	217.4 (±172.9)
5. Smallholder rain-fed dry/cold	89,992	158,713	142.3 (±130.8)
6. Dualistic mixed[3]	-	-	-
7. Coastal artisanal	-	-	-
8. Urban-based and kitchen garden	1,230	805	159.4 (±42.3)
[4]Weighed mean	1,795,544	1,910,884	256.6
Asia and the Pacific (n* = 272)			
1. Smallholder irrigated	-	-	-
2. Wetland rice	7,226,414	4,986,283	22.0 (±32.3)
3. Smallholder rain-fed humid	225,248	102,336	123.0 (±183.3)
4. Smallholder rain-fed highland	256,037	151,570	67.4 (±73.7)
5. Smallholder rain-fed dry/cold	474,120	509,987	86.8 (±71.3)
6. Dualistic mixed[3]	90	225,190	45.2 (±34.9)
7. Coastal artisanal	-	-	-
8. Urban-based and kitchen garden	179,000	27,085	243.1 (±132.4)
[4]Weighed mean	8,360,909	5,997,451	132
Latin America (n* = 55)			
1. Smallholder irrigated	-	-	-
2. Wetland rice	-	-	-
3. Smallholder rain-fed humid	56,073	145,244	120.6 (±103.4)
4. Smallholder rain-fed highland	26,322	31,939	134.6 (±101.6)
5. Smallholder rain-fed dry/cold	15,000	60,000	50
6. Dualistic mixed[3]	466,132	23,290,651	61.5 (±30.4)
7. Coastal artisanal	220,000	160,000	62.0 (±28.3)
8. Urban-based and kitchen garden	26,250	8,062	96.8 (±58.9)
[4]Weighed mean	809,777	23,695,896	161.9

Notes: Author's creation

[1] Based the farming systems classification of Dixon et al. 2001

[2] Yield data reported as the % increase in yield from levels before the inititiation of the project

[3] Dualistic refers to mixed large commercial and smallholder farming systems, mainly from southern Latin America

[4] Weighed mean is based on the area occupied by each of the farming systems and is calculated as follows: Ó (S_i x A_i)/Ó A_i where S_i is the average yield increase for system *i*; A_i is the area occupied by S_i

n* denotes number of cases assessed

percent and 161.9 percent, respectively. Overall, in the aforesaid three regions smallholder rain-fed humid farming systems consistently gave relative yield increases in excess of 100 percent although the standard deviation was one of the highest. This manifests the high degree of variability in these increases (table 3). These farming systems are characterized by having a crop component that could include root crops, cereals, industrial tree crops and commercial horticulture or a mixed crop-livestock system (Dixon et al. 2001). The high degree of variability in yields observed in these farming systems may, in part, be attributed to their dependence on annual rainfall. Similarly, smallholder rain-fed highland systems showed consistent increases in relative yields, along with a large degree of variability. In a broad overview of recent projects regarding sustainable agricultural practices and technologies in 52 countries, Pretty and Hine (2001) showed that yield increases as a result of introducing practices such as water-harvesting, conservation tillage and drip irrigation amounted to 50–100 percent. Clearly, there are considerable gains to be made in the productivity of rain-fed production systems through simple interventions. However, a farmer's investment decisions are strongly influenced by his/her risk perceptions. Risk of reduced or no return on invested capital in rain-fed semi-arid farming is directly related to the unreliable rainfall distribution (Rockström et al. 2003).

Yields of selected agronomic commodities, before and after the development of the 'Bright Spot', are presented in table 4, along with the dataset of seven crops that are represented in both Africa and the Asia and Pacific regions. A comparison of the yields before the development of the 'Bright Spot' indicates that productivity of these commodities were, in most cases, lower in the African region than that of the Asia and Pacific region (table 4). In the case of maize production, the mean yield was lowest in Africa before the establishment of 'Bright Spots', when compared with that of Asia and the Pacific and Latin America (figure 3). However, with the development of the 'Bright Spot', yields of maize increased significantly in Africa recording the highest relative gains (figure 3). This may, in part, be associated with the variable climatic conditions often experienced in dryland cropping systems, along with the lower inputs linked to production systems in Africa. If, it is assumed that the average intake of maize per person per day is 1 kg, for a household of 4 individuals, the total annual maize requirement for household consumption would be 1.46 t. It is, clearly evident from the data presented in figure 3 that

TABLE 4.
Yield difference for selected agronomic commodities before and after the development of a Bright spot for each of the regions. Values in parenthesis are the standard error of the mean.

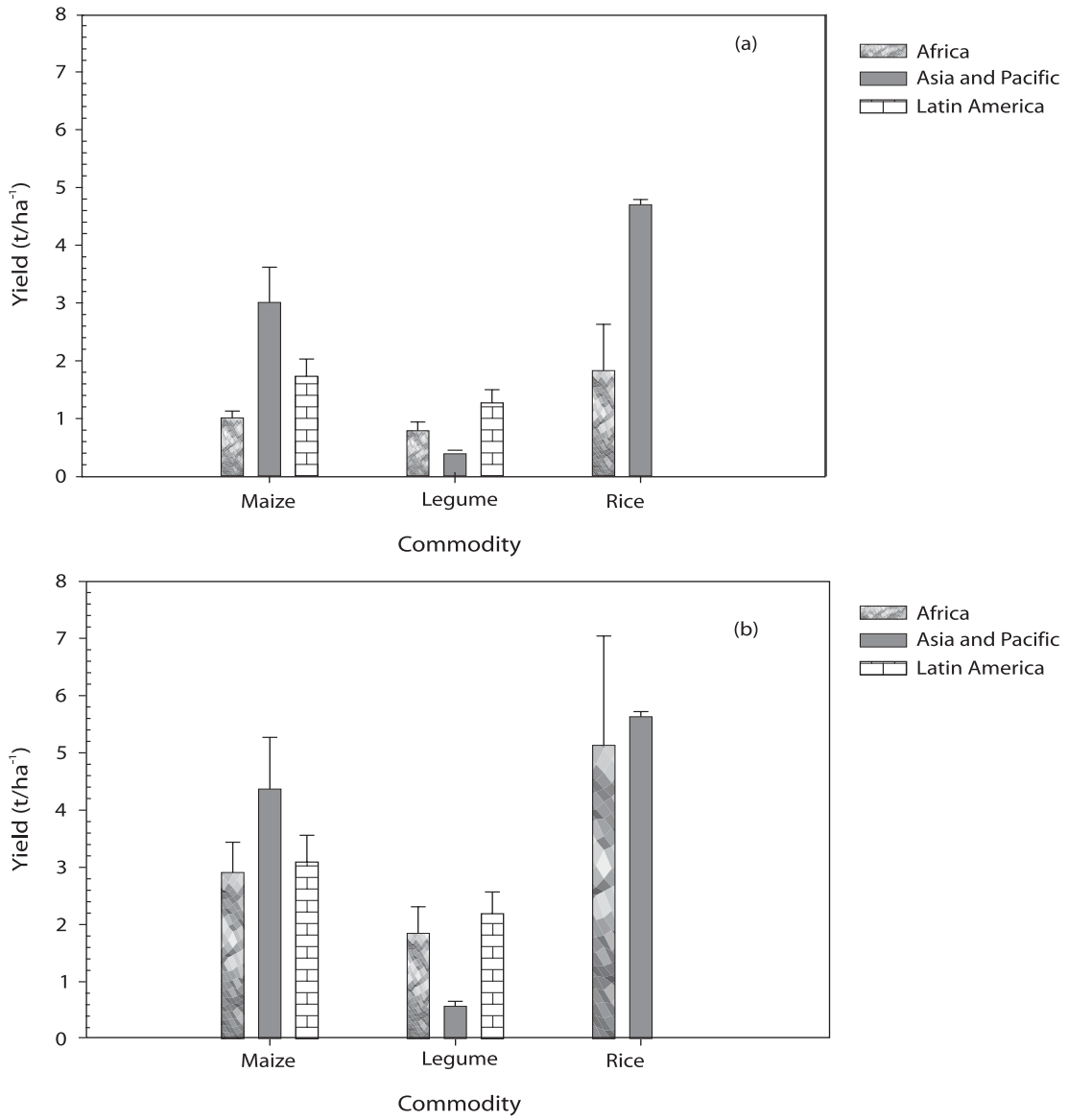
Commodity	Before			After		
	Africa	Asia and Pacific	Latin America	Africa	Asia and Pacific	Latin America
t ha^{-1}						
Cotton	0.86 (±0.41)	2.21 (±0.26)	-	1.02 (±0.53)	2.94 (±0.15)	-
Maize	1.01 (±0.12)	3.01 (±0.61)	1.73 (±0.30)	2.91 (±0.53)	4.37 (±0.90)	3.09 (±0.47)
Legume grains[1]	0.79 (±1.85)	0.39 (±0.06)	1.27 (±0.23)	1.85 (±0.46)	0.57 (±0.09)	2.19 (±0.38)
Rice	1.83 (±0.80)	4.70 (±0.09)	1.52	5.13 (±1.91)	5.63 (±0.09)	2.45
Root[2]	4.70 (±1.36)	13.09 (±3.92)	6.92 (±1.49)	25.00 (±6.45)	21.69 (±6.21)	14.08 (±2.48)
Sorghum	0.71 (±0.13)	0.57 (±0.13)	-	1.56 (±0.24)	1.14 (±0.26)	-
Wheat	0.79 (±0.09)	3.89 (±0.09)	-	2.33 (±0.33)	4.64 (±0.10)	-

Notes: Author's creation

[1] Legume grains include field peas, soybean, and beans

[2] Root crops include potato, cassava and sweet potato

FIGURE 3.
Changes in yields of selected agronomic commodities before (a) and after (b) the development of Bright spots in Africa, Asia and the Pacific, and Latin America. Vertical bars are the standard error of the mean.



Note: Author's creation

yield improvements associated with the development of a 'Bright Spot' exceed this value. Hence a surplus in production is plausible, which could then be sold in the market generating increased incomes for the household.

Two of the cases presented in the dataset, were projects that involved the adoption of no-till (*plantio dierto*) in the states of Paraná and São Paulo, Brazil. Yield increases in maize and soybean ranged from 2.0–4.5 t $ha^{-1,}$ and the average farm-size ranged from 12.5–30.0 ha (data not presented). With these improvements in yield, it is not surprising as to why this conservation-based production system has been adopted by over 200,000 farmers in southern Brazil (Pretty and Koohafkan 2002). The adoption of no-till production systems was, in part, attributed to retail outlets of agrochemicals and machinery factories working closely with farmer associations and extension agents to develop appropriated production machinery for large- and small-scale farmers (Ralisch et al. 2006).

Data presented in table 4 and figure 3 demonstrate the positive impact of 'Bright Spots' on staple commodities at a continental level. While it is often assumed that base productivity levels are at a much lower level in Africa and that significant increases can be achieved through the adoption of improved production practices, it is also important to note that in both regions, namely Asia Pacific and Latin America, significant gains can be realized through the development of 'Bright Spots'.

It is clearly evident that there have been substantial increases in productivity associated with the adoption of improved farming practices. These practices included:

- supplemental irrigation and multiple cropping that improved water use efficiencies;
- organic-based farming systems that improved soil fertility; and
- minimum to low pesticide usage that improved weed and pest control.

While the focus has been on productivity increases, several of the projects were watershed based. In these cases significant gains in agronomic productivity were supplemented by the additional focus on improving environmental quality. This included the reforestation of upper watershed areas with trees, which resulted in improved water quality, lower soil loss and improved water access.

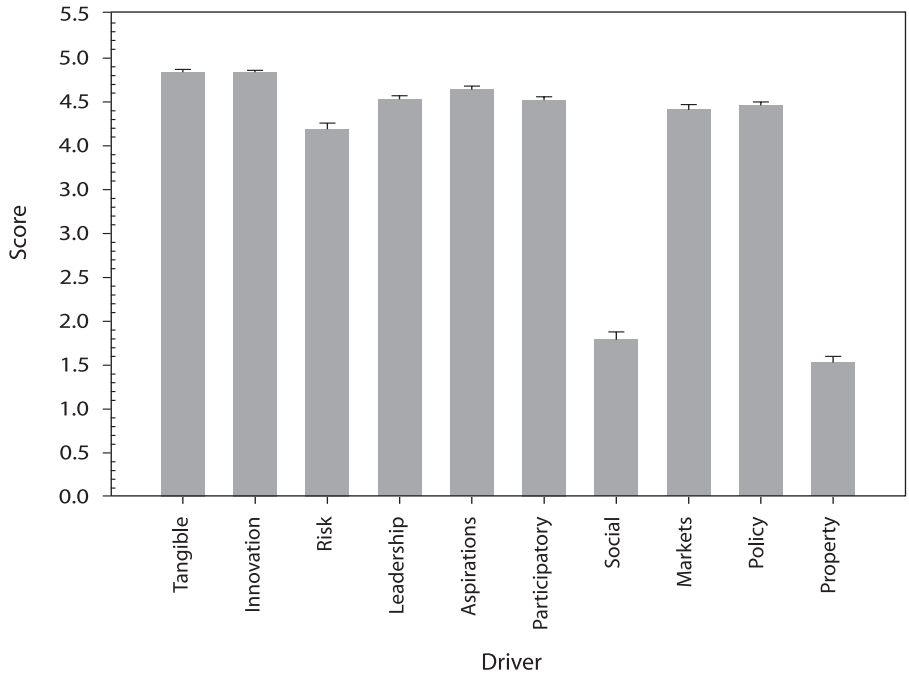
Drivers

A Global Assessment of Drivers

Using data from 245 completed questionnaires where respondents were asked to score the importance of 10 drivers on a scale of 1–5 with 5 being the highest or most important, an assessment of their significance in the success of the development of 'Bright Spots' was undertaken. It should be made clear at the outset, that the key drivers assessed in this analysis are not exhaustive, only the ten, which the research team (from a multi-disciplinary background) considered to be the most important components that need to be addressed in order for a 'Bright Spot' to develop are represented.

The outcomes of the global analysis of the scores and respective rankings of drivers are presented in figure 4. Both, quick and tangible outcomes and technological innovations were ranked the highest out of the group of ten drivers. It stands to reason that quick and tangible outcomes are a high priority for resource-poor subsistence farmers, who do not have the financial capacity to undertake long-term strategic interventions. In addition, these positive outcomes i.e., productivity improvements, need to be large enough that the farmer or community group can enjoy the rewards. The introduction of new approaches and technologies through innovation received a high score, highlighting the importance of new knowledge. Drivers associated with the aspirations of individuals, leadership, participation of the community, supportive policy, markets and the risk associated with adopting changes were scored between 4.19 and 4.64 (figure 4). Social capacity and property rights both scored significantly lower than all other drivers with values of 1.79 and 1.53, respectively (figure 4). This may, in part, be attributed to the fact that the majority of the cases focused on enhancing productivity at the field level, where social capital would play a lower role. In addition, property rights assumed a lower rating, since the predominance of cases studied were associated with individuals and communities who were not landless. The analysis confirms the importance of most of the selected drivers in the development of a 'Bright Spot'. As the scores in eight of the ten drivers exceed 4.0 suggest that all of these drivers are potentially very important in effecting change.

FIGURE 4.
Global assessment of drivers with respect to their importance in the development of Bright spot cases. A total of 245 cases were analyzed. Vertical bars represent the standard error of the mean.



Note: Author's creation

Type of 'Bright Spot'

The different cases that were received in this survey could be broadly classified into three general types based on the level of social organization, at which change had to occur, namely:

- those related to effecting change with respect to the 'individual';
- watershed-based interventions that have a clear focus on mobilizing communities and groups that could be classified as having a strong 'community' orientation; and
- an 'intermediate' of the two types that are represented by irrigation-based projects, these being predominantly from Africa.

Individual

Selected cases collected from south Asia offered an opportunity to assess the drivers associated with the development 'Bright Spots', in which the primary actor is the individual farmer. These cases were drawn from two locations on the Indian subcontinent, namely south India and the Punjab. These cases had a focus on introducing new technologies associated with improved rice production, including: (a) integrated nutrient management; promotion of organic farming systems (composts, bio-fertilizers); and (b) use of new planting material and crop husbandry techniques. An analysis of the individual drivers associated with each of the datasets is presented in figure 5. The ranking of the drivers associated with the development of the 'Bright Spots' were similar regardless of location, with quick and tangible outcomes associated with the change and innovation ranking the highest. In addition, low-risk associated with the development of the 'Bright Spot' too ranked high. In contrast, social aspects ranked low, which intuitively would reflect the individual nature of the intervention. Property rights also ranked low, this may be due to the individual adopting the improved practices already possessing his/her farming unit or having

access to land. In all of the cases analyzed from these datasets there was an external primer that introduced the concept of the new technology, benefits of which largely accrued to the individual.

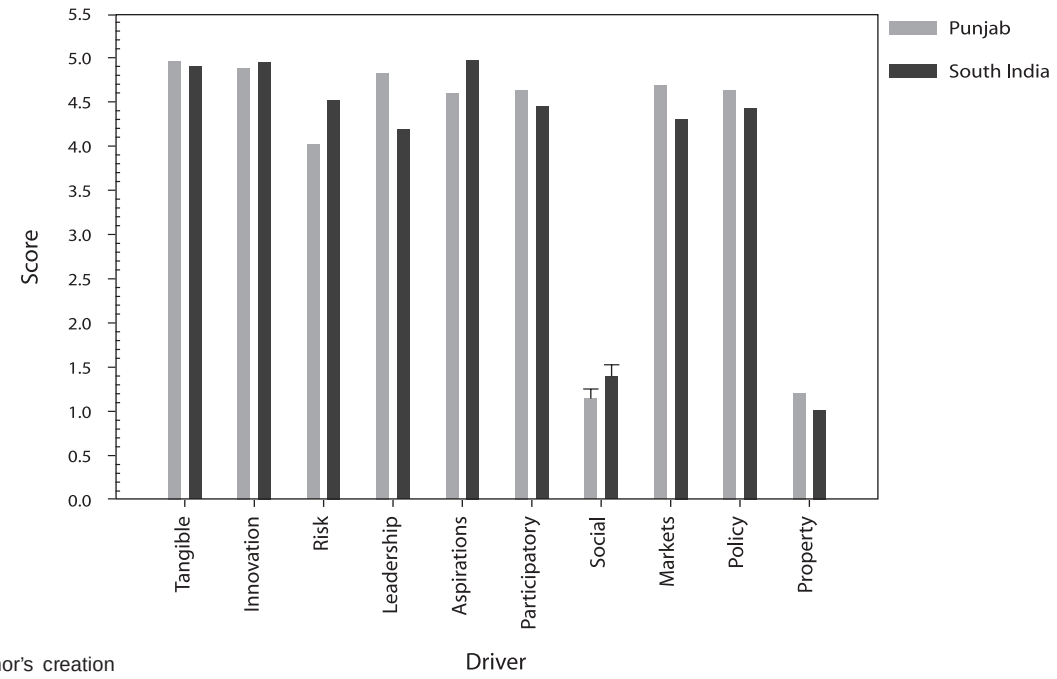
Intermediate—Small-scale Irrigation-based Cases

Similar to the 'individual' type 'Bright Spot', small-scale irrigation cases resulted in low scores being achieved in both social capital and property rights (figure 6). It is of note that the score-values for social capital and property rights were higher in the case of these 'intermediate' type 'Bright Spots' than in the 'individual' type, suggesting a greater relevance of these two drivers in cases of the former type. Low-risk also tended to have a lower rating in the 'intermediate' type, this being due to the lower risk of crop failure associated with the presence of either full or supplementary irrigation.

Community/Watersheds

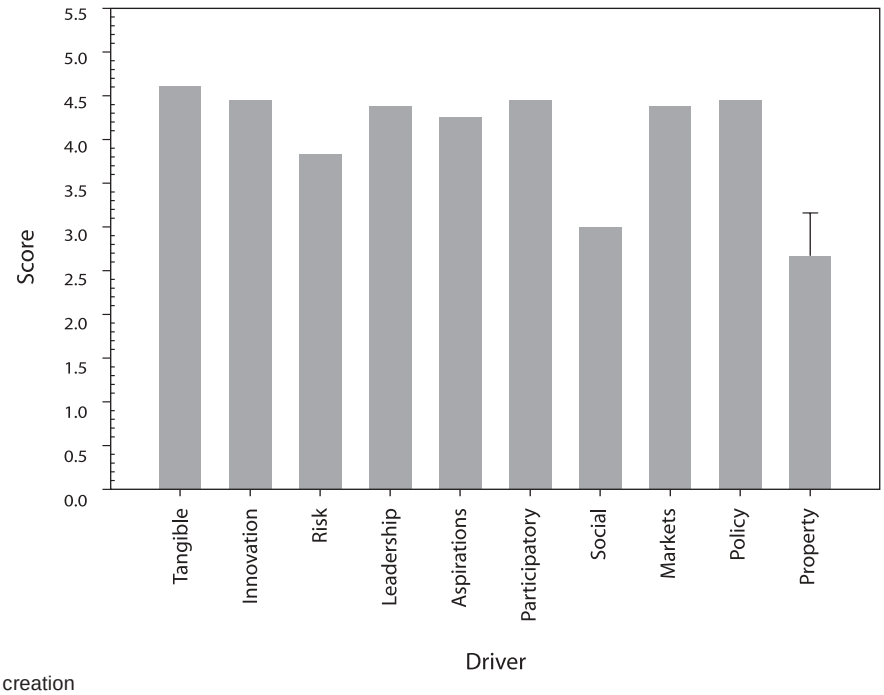
An analysis of the drivers associated with watershed-based cases is presented in figure 7. Property rights had the lowest ranking, followed by low-risk and aspirations. As the focus of a watershed-based case is on effecting positive changes among all members of the community, the influence of property rights as a driver would diminish. Similarly, risk would effectively rank low as it could be perceived that risk is borne by the community as whole and not a single individual. Leadership, participation, social capital and innovation drivers all ranked high as key attributes that facilitated the development of watershed-based 'Bright Spots' (figure 7). It is of note that in contrast to the other types of 'Bright Spots' (figure 5 and 6), the scores for all of the drivers were above 3, indicating the relative importance of all of these drivers in effecting change within a watershed-based or community-based project.

FIGURE 5.
Scores associated with drivers that contribute to the development of Bright spots that have a strong impact to the 'individual' from a survey of smallholder farmers in the Punjab (n=110) and south India (n=94). Vertical bar represents the least significant difference ($LSD_{0.05}$) between treatment means of the same region.



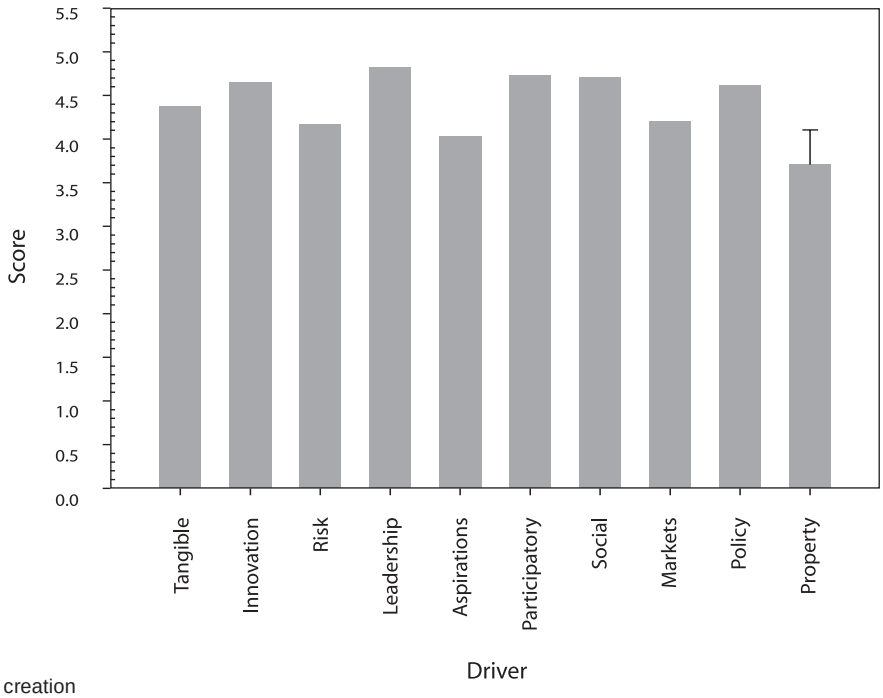
Note: Author's creation

FIGURE 6.
Scores associated with drivers that contribute to the development of 'Bright' spots associated with smallscale irrigation development (n=31). Vertical bar represents the least significant difference ($LSD_{0.05}$) between treatment means.



Note: Author's creation

FIGURE 7.
Scores associated with individual drivers that contribute to the development of 'Bright Spots' associated with watershed development (n=17). Vertical bar represents the least significant difference ($LSD_{0.05}$) between treatment means.



Note: Author's creation

Box 3. Development of Local Seed Varieties in the Central and Southern West Bank, Palestine.

Nancy Odeh, Stockholm Environment Institute, Boston, USA.

In the late 1980s a PARC (Palestinian Agricultural Relief Committee) extension worker, Ismail Daiq, observed that the productivity of local crops had decreased — the productivity of watermelons was shrinking dramatically and local tomatoes had nearly lost their entire market share. In 1989, PARC and the British charity United Nations Association International Service UNAIS launched a program for reversing the alarming decline through the use and productivity of local seed varieties. Local (or traditional) seeds are those produced in a particular place or climate and that have been selected and maintained by local people in their local growing environment. Over a period of time, as farmers saved the seeds from their best-performing plants, these local seeds have developed through farmer selection. This traditional system has functioned well and is the basis of today's field-breeding programs. From the synergy of farmer selection, knowledge and the natural selection process of local varieties (*landraces*) have emerged, which are ideally suited to prevailing climatic and edaphic conditions. These local vegetable seed varieties play an essential social, economic and environmental preservation role in dryland agriculture, which predominates throughout 90 percent of Palestine.

The problem noted by Ismail Daiq at PARC was that, despite these benefits, local farmers were increasingly turning to 'introduced' varieties in order to take advantage of a wider marketing season and other opportunities. Modern methods of agricultural development, promoted by the seed industry and by agrochemical and agro-business interests heightened disregard for local seeds. Most vegetable-producing areas have experienced an accelerated deterioration of variety since the 1980s, because cross-pollination occurs between the local and introduced varieties when cultivated alongside one another. This leads to a 'dilution' or loss of the desirable characteristics of local seeds. The traditional seed-saving knowledge was no longer able to preserve the stability and quality of local varieties. As a result, farmers planted substandard local varieties or less suitable 'standard' varieties and their incomes declined. They often had to abandon their land as it ceased to support their livelihoods.

The PARC-UNAIS project began by asking the farmers in the area to identify the problems and suggest solutions to them. The project was implemented with the active participation of local farmers, extension workers, and a seed development expert — in fact, participation was a key concern and top priority. These groups were all involved in the baseline survey as well as the implementation of the seed improvement activities, based on natural selection and the monitoring of the plants. Local farmers were chosen based on the criteria of being interested in the project and having isolated plots of land, which was necessary to ensure a successful process of natural selection. After the first round of breeding work was completed, the improved seeds went through field trials by local farmers. Evaluation data was obtained through extension visits and evaluation workshops.

Since 1993, the project has been successfully implemented in the central and southern West Bank and recently activities were extended to Northern areas as well. Twenty-nine local varieties of vegetables have been in development. The project has resulted in improved local seed varieties with more attractive shapes of fruits, higher productivity, and increased resistance to pests. More than 300 farmers evaluated the improved varieties, and were satisfied with the results. There is a high demand for improved seeds, especially because cultivating these varieties has led to significant increases in income due to enhanced crop-quality and yield. On-farm seed production models were also developed for 18 improved varieties in their original areas of cultivation. Farmers produce seed

under a voluntary field inspection and seed growing control system provided by the project, which facilitates the seed quality to be guaranteed. Annually, the seed distribution directly benefits 200 to 300 farming families. Because of the tiny amounts available for distribution, farmers are zealously motivated to save their own seeds from the project's improved local crops and to use them for planting. They also share these seeds with their neighbors. The strategy for scaling out was based not on perfecting a product and then disbursing it widely, but by involving local farmers in the very design phase of the project. This allowed for demonstration learning as well as opportunities to adapt the process to local realities, including seed varieties.

This case study is featured in Volume 1 Global Synthesis and Volume VI West Asia and North Africa of the series *Civic Entrepreneurship – A Civil Society Perspective on Sustainable Development* (Eds. Tariq Banuri, Adil Najam, and Nancy Odeh, 2002). The series is also available electronically on the website of the Stockholm Environment Institute – Boston Center *http://www.seib.org/*

Maryam Rahmanian from Centre for Sustainable Development CENESTA in Iran conducted research for this case study through interviews with Palestinian Agricultural Relief Committee (PARC) employees.

Financial Investments in Change

Within the questionnaires that were sent out, respondents were given the option of disclosing the financial contributions that were made to the project to assist in the development of the 'Bright Spot'. These sources of funding were categorized into the following:

- bilateral funding;
- funding from international donors;
- national governments;
- communities;
- nongovernmental organizations (NGO's); and
- other sources.

While a comprehensive economic analysis of investments and returns are beyond the scope of this analysis. However, an assessment of the sources and magnitude of external contributions for specific cases from Africa and Latin America is undertaken in this study.

Latin America

A total of ten respondents included a breakdown of funds expended during the course of the project and these are presented in table 5. Funds committed to individual projects ranged from US$3,000 to US$10.5 million. The largest source of funds associated with the development of these projects was from bilateral and international donors. Eight of the projects had partial funding from national governments and three had direct funding support from the community. In the latter case, in-kind contributions to projects such as labor, were not taken into account but would invariably be significant, particularly in the case of watershed development projects. The total direct financial commitment that has gone into the development of these selected 'Bright Spots' is substantial. The effective cost per ha of land influenced by a 'Bright Spot' was estimated to US$997 ha^{-1} (range US$1.2–US$25,000 ha^{-1}).

TABLE 5.
Funds expended from different sources in the development of selected 'Bright Spot' projects in Africa and Latin America.

		Financial sources (US$)						
Project No.	Area (ha)	Bilateral	International	National Government	Community	NGO	Other	Total
Africa								
AF300	100			161,860	46,359	231,802		440,021
AF301	50			60,134	72,559	311,188		443,881
AF302	200			87,133	31,769	198,880		317,782
AF303	90			107,498	78,224	458,621		644,343
AF304	150						877,675	877,675
AF305	110						482,050	482,050
AF306	150						245,443	245,443
AF307	90						382,085	382,085
AF308	50						496,953	496,953
AF309	-		45,000					45,000
AF311	8,000	25,000				7,000	800,000	832,000
AF312	-	4,400					252,000	256,400
AF313	7,800	150,000		20,000		10,000	5,000	185,000
AF314	500	250,000			2,000			252,000
AF316	250					226,901	82,179	309,080
Total	17,540	429,400	45,000	436,625	323,090	1,434,392	3,541,206	6,209,713
Latin America								
LA105	200	5,000,000						5,000,000
LA106	-		8,000,000	500,000				8,500,000
LA107	12,000	8,000,000		2,500,000				10,500,000
LA108	4,332		3,150,000	900,000	360,000			4,410,000
LA111	2,500			3,000				3,000
LA112	6,640			1,500,000				1,500,000
LA114	-		150,000	60,000				210,000
LA115	4,528		45,000	45,000	4,500			94,500
LA117	90			10,000				10,000
LA118	30				10,000	10,000	1,000	21,000
Total	30,320	13,000,000	11,345,000	5,518,000	374,500	10,000	1,000	30,248,500

Note: Author's creation

It is of note that the total direct investment by National Governments in selected cases amounted to US$5.5 million, which when compared to the overall budget of these cases resulted in a leverage ratio (Total cost/Total National Government expenditure) of 5.48 for the selected cases (table 5).

Africa

A total of 15 respondents to the questionnaire indicated the breakdown of funds expended during the implementation of the relevant projects (table 5). Funds committed to the development of individual projects ranged from US$45,000 (Project No.AF309) in the case of Sutaa-Nuntaa Rural Development Program in Ghana that focuses on food security and the empowerment of women in rural communities to US$877,675 (Project No. AF304) in a small-scale irrigation project in Ethiopia. The largest source of funds associated with the development of these projects was under 'others' that included predominantly direct foreign government funding (table 5). This was followed by significant funds from NGO's (table 5). It is interesting to note that in this set of projects the ratio of National Government expenditure to the total investment resulted in a leverage ratio 14.22, which is considerably larger than that of Latin American projects. The mean investment was estimated at US$354 ha^{-1}, which is approximately one-third of what is invested in the Latin American cases (previously discussed). In the small-scale irrigation projects the average cost incurred was found to be US$490 ha^{-1}. An exhaustive analysis of the average cost incurred in the development of formal irrigation schemes in sub-Saharan Africa over the past several decades, has revealed that it can be as high as US$5,700 ha^{-1}, with small schemes being even more expensive than large ones (Merrey et al. 2005). Lower contributions from private funds for these small schemes in comparison to what they contribute to 'Bright Spots' may be one reason for the increase in the average cost. However, a ten-fold difference is very significant indeed. It may be concluded that it is quite likely the informal, bottom-up approach to development leading to 'Bright Spots' is a much more effective use of public funding than development of formal irrigation schemes.

Concluding Remarks

The results from the current study suggest that the numerous global examples of 'Bright Spots' have had significant positive benefits to individuals and communities, and may even help alleviate food poverty in those communities. The observed increases in productivity of crops can help ensure household food security and potential income generation. One of the most important features of these documented 'Bright Spots' is that they have already occurred within local contexts including market, institutional, and policy environments. The cases represent a wide variety of farming systems and innovations, which can all be considered as resource-conserving technologies. These systems have been implemented in various ways ranging from extension aimed at individuals to community-organized watershed management by implementing groups including NGOs and government services. These cases provide compelling evidence that improvement is possible, even though global degradation trends are still a major concern. An important feature of these productivity gains is not that they are easily possible, which has been well known for decades, but that they were achieved by implementing resource-conserving agricultural techniques e.g., realizing an increase in the yield while preserving and restoring the existing resources.

In the majority of cases the development of the documented 'Bright Spot' was contingent on an external priming agent, which facilitated the 'Bright Spot' through financial and nonfinancial contributions. For example, in the 17 watershed-based projects analyzed, 13 cases provided estimates on the costs associated with their development. The total amount invested was approximately US$32 million. These types of 'Bright Spots' that focus on community mobilization and building social capital are invariably costly. This factor is substantiated by the estimated expenditure of US$2.5 billion on watershed development in India over the period 1951–2004 (Joshi et al. 2005). This implies that further development and replication of 'Bright Spots' is contingent on significant financial and nonfinancial resources. Mobilization of the required resources will require significant shifts in investment policies with the emphasis on smallholder farmers, particularly in the rain-fed areas. The required shift in focus for development efforts is already being called for in many policy recommendation documents (the recent Copenhagen Consensus results 'Putting the World to Rights', *Economist*, June 3, 2004; Inter Academy Report of 2004 on potential of agricultural growth in Africa; Rockström et al. 2003).

There are, in addition, cases of what could be termed spontaneously driven 'Bright Spots' that grew from within without incentives or external support (Noble et al. 2005). Three Uzbekistan cases represent the concept of spontaneous development that are contingent on the abilities and skills of individuals or communities. In addition, there are several examples of farmer innovations that have been documented, and they explicitly exhibit spontaneous elements in their development, which gives us cause for hope and tempers the comments made in the previous paragraph (Mutunga and Critchley 2001).

It is argued that a key element in the success of 'Bright Spots' is the perceived importance of individual aspirations and leadership, the latter being particularly important in community-based 'Bright Spots'. Aspiration effectively encapsulates the concept of willingness of individuals and communities to undertake change. The ability of an individual or community to realize the predicament in which they are in, how they got there in the first instance, and the way forward is a significant probability in the processes resulting in change. This process may develop internally as presented in the case studies from India (D'Silva and Nagnath. 2005) or facilitated through a priming agent, which could be a government organization or nongovernmental organization. As the majority of cases reported had an external priming agent that provided financial support and advice in the development of the 'Bright Spot', clearly reflects the importance of these external factors in effecting their development. It is also evident from the analysis of these cases that two key elements in the development of 'Bright Spots' are new knowledge and innovation that promotes change. These are important attributes even in the development of spontaneous forms of 'Bright Spots' (Noble et al. 2005; D'Silva and Nagnath 2005). Innovation by its very nature involves new knowledge and insight.

A common thread that links the majority of documented cases, which have been discussed in this report and best encapsulates their attributes is the term *entrepreneurship* as defined by Schumpeter (1934). The Schumpeterian entrepreneurs are not necessary 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 presented, elements of these attributes are present through individuals adopting new approaches.

In most of the 'Bright Spot' cases, the form of entrepreneurship is driven specifically by the public interest, which seeks to create not

necessarily a new way of making a profit but a new way of building social capital and a new way of showing how to harness existing ideas, methods, inventions, technologies, resources or management systems to the service of collective goals (Banuri and Najam 2002). Banuri and Najam (2002) make a thoughtful and appropriate analogy of sustainable development that is pertinent to these 'Bright Spots'. They conclude *"… sustainable ('Bright Spot') development can best be analogized to the growth process of a tree, starting from a single seed, rooted in the soil, dependent on its compatibility with the environment and at least in its early years, requiring persistent attention and care. Every seed has the potential to become a tree, but not every seed will become a tree. Unlike the house or the river, its evolution is not predetermined by the dictates of the blueprint or the gradient."*

As indicated above there is no blueprint for the development of a 'Bright Spot' (Banuri and Najam 2002). However, the analysis of drivers does allow us an insight into the key elements that are important in their development. The six drivers identified as a high priority in the development of community-based 'Bright Spots' that have a focus on collective mobilization 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. While we should treat this analysis with caution based on the limited sample number (n=33), it does give an indication of the relative importance of drivers in the development of a community-based 'Bright Spot'.

In individual-based 'Bright Spots', which in this analysis are dominated by returns from India, the benefactor is predominantly the individual and involves the adoption of a new technology or improvements in their current farming practices. In analyzing 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) a participatory approach in implementing the technology; (b) strong leadership by the individual or group adopting the technology; (c) supportive policy; and (d) markets. It is interesting to note that the risk factor was given a significantly ($p<0.05$) lower score than the other 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. Similarly, social capital and property rights were viewed as having a low priority.

Fundamental to the development, continuance 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 effects positive changes. Far too often knowledge is taken as a given, when in reality there are serious flaws in the level of receptiveness of the target audience that precludes effective assimilation and utilization of new knowledge. This is a challenge that will continue to influence the success of development-based projects.

Literature Cited

Banuri, T.; Najam, A. 2002. Civic Entrepreneurship. A civil society perspective on sustainable development. Pakistan. *Global Synthesis* Volume 1: 88-93.

Banuri, T.; Najam, A.; Odeh, N. 2002. Civic Entrepreneurship. A civil society perspective on sustainable development, Pakistan, eds. Tariq Banuri, Adil Najam and Nancy Odeh. *Global Synthesis* Volumes 1-7.

Carney, D. 1998. *Sustainable Rural Livelihoods*. Department for International Development. London, U.K.: Dept. for International Development.

Coleman, J. 1990. *Foundations of Social Theory*. Cambridge, Massachusettes, USA: Havard University Press.

Costanza, R.; d'Arge, R.; de Groot, R.; Farber, S.; Grasso, M.; Hannon, B.; Limburg, K.; Naem, S.; O'Neil, R. V.; Paruelo, J.; Raskin, R. G.; Sutton, P.; van den Belt, M. 1997. The value of the world's ecosystem services and natural capital. *Nature* 387: 253-260; also *Ecological Economics* 25: 3-15.

Crissman, C. C.; Antle, J. M.; Capalbo, S. M. (eds.) 1998. *Economic, Environmental and Health Tradeoffs in Agriculture*. Pesticides and the Sustainablity of Andean Potato Production. Dordrecht/Boston/London USA: CIP, Lima & Kluwer.

Critchley, W.; Brommer, M. 2003. Innovation and infiltration: Human ingenuity in the face of water shortage in India and Kenya. *International Symposium on Water, Poverty and Productive Uses of Water at the Household Level. Muldersdrift, South Africa.* pp 74 – 82.

Dixon, J.; Gulliver, A.; Gibbon, D. 2001. *Farming Systems and Poverty*. Rome, Italy: Food and Agriculture Organization (FAO).

D'Silva, E.; Nagnath, B. 2005. *The making of new Powerguda: Community empowerment and new technologies transform a problem village in Andhra Pradesh.* Global Theme on Agroecosystems Report No. 11, eds. S.P. Wani; J.W. Kijne; R. Barker and D. Molden. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

FAOSTAT. (2003). Available on the World Wide Web:—http://faostat.fao.org/default.aspx.

Joshi, P. K.; Jha, A. K.; Wani, S.P.; Joshi, L.; Shiyani, R. L. 2005. *Meta-analysis to assess impact of watershed program and people's participation.* Comprehensive Assessment Research Report 8. Colombo, Sri Lanka: Comprehensive Assessment Secretariat.

Kitevu, R.; Kituyi, E.; Motari, M. 2002. Kenya. In *Civic Entrepreneurship. A civil society perspective on sustainable development,* Pakistan, eds. Tariq Banuri, Adil Najam and Nancy Odeh. *Global Synthesis* 2: 80.

Krishna, A. 2002. *Active social capital: Tracing the roots of development and democracy*. New York, USA: Columbia University Press.

Merrey, D., Inocencio, A., Penning de Vries, F., Moradet, S., Van Koppen, B., McCatney, M., Sally, H., Peden, D., Boelee, E., Cofie, O., Namara, R. 2005. Water for Agriculture: Real Opportunities to Invest in sub-Saharan Africa. First Draft of Synthesis Report for the Collaborative Program between the New Partnership for Africa's Development (NEPAD), the African Development Bank (AfDB), the Food and Agriculture Organization of the United Nations (FAO), the International Fund for Agricultural Development (IFAD), the International Water Management Institute (IWMI), and The World Bank (WB) on "Investment in Agricultural Water Management in sub-Saharan Africa: Diagnosis of Trends and Opportunities."

Mutunga, K.; Critchley, W. 2001. Farmers Initiative in Land Husbandry: Promising technologies for the drier areas of East Africa. Regional Land Management Unit (RELMA), Technical Report Series 27. Swedish International Development Cooperation Agency (SIDA). RELMA.

Noble, A. D.; ul Hassan, M.; Kazbekov, J. 2005. *"Bright Spots" in Uzbekistan, reversing land and water degradation while improving livelihoods: Key developments and sustaining ingredients for transion economies of the former Soviet Union*. Research Report 88. Colombo, Sri Lanka: International Water Management Institute (IWMI).

Norse, D.; Li Ji, J. L..; Zhang, Z. 2001. *Environmental Costs of Rice Production in China*. Bethesda, Aileen International Press.

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

Pretty, J. 1998. The Living Land: Agriculture, Food and Community Regeneration in Rural Europe. London, UK: Earthscan.

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', FAO Committee for Food Security, Rome.* June 2001.

Pretty, J.; Brett, C.; Gee, D.; Hine, R.; Mason, C. F.; Morison, J. I. L.; Raven, H.; Rayment, M.; van der, Bijl. G. 2000. An assessment of the total external costs of UK agriculture. *Agricultural Systems* 65 (2): 113-136.

Pretty, J.; Hine, R. 2000. The promising spread of sustainable agriculture in Asia. *Natural Resources Forum* 24: 107-121.

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

Pretty, J.; Hine, R. 2004. *Measuring progress towards agricultural sustainability in developing regions.* Report to the UK Department for International Development (DFID) Project CNTR 02 4047: An Analysis of Findings from the University of Essex SAFE 2 Project.

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

Pretty, J.; Bell, A. S.; Li, Xiaoyuan; Ravindranath, N. H. 2002. The role of sustainable agriculture and renewable resource management in reducing greenhouse gas emissions and increasing sinks in China and India. *Philosophical Transactions of the Royal Society* Series A. 360: 1741-1761.

Pretty, J.; Morison, J. I. L.; 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.; Penning de Vries, F.; Morison, J.I.L. 2006. Resource-Conserving Agriculture Increases Yields in Developing Countries. *Environmental Science and Technology* 40 (4): 1114-1119.

Pretty, J. N.; Smith, D. 2004. Social capital in biodiversity conservation and management. *Conservation Biology* 18: 631-638.

Pretty, J. N.; Ward, H. 2001. Social capital and the environment. *World Development* 29: 209-227.

Ralisch, R.; Ayarza, M.; Abi-Saab, O. J. G. 2006. *Drivers effecting development and sustainability of no-till systems for smallholders at the watershed level in Brazil*. IWMI Research Report (in review).

Rockström, J.; Barron, J.; Fox, P. 2003. Water productivity in rain-fed agriculture: Challenges and opportunities for smallholder farmers in drought-prone tropical agroecosystems. In: *Water productivity in agriculture: Limits and opportunities for improvement,* eds. J. W. Kijne, R. Barker and D. Molden. Cambridge, USA: CABI Publishing. pp 145-162.

Scherr, S. J. 1999. *Soil degradation. A threat to developing country food security by 2020?* Discussion Paper 27. Washington, D.C.: (USA). International Food Policy Research Institute (IFPRI). p 71.

Schumpeter, J. A. 1934. *The theory of economic development: An inquiry into profits, capital, credit, interest and the business cycle.* Cambridge, Massachusettes, USA: Harvard University Press.

Scoones, I. 1998. *Sustainable Rural Livelihoods: A Framework for Analysis.* IDS Discussion Paper, 72. Sussex, UK: University of Sussex.

Sreedevi, T.K.; Shiferaw, B.; Wani S.P. 2004. *Adarsha watershed in Kothapally: Understanding the drivers of higher impact. Global Theme on Agro-ecosystems.* Report No. 10. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

Tegtmeier, E. M.; Duffy, M. D. 2004. External costs of agricultural production in the United States, *International Journal of Agricultural Sustainability* 2: 155-175.

Waibel, H.; Fleischer, G.; Becker, H. 1997. *Agrarwirtschaft* 48 (6): 219 – 230.

Annex 1: Questionnaire Distributed

‘Bright Spots’ Research Project

Drivers Effecting Their Development and Sustainability Questionnaire

The ‘Bright Spots’ Research Project

This is a collaborative research project that is being coordinated by the International Water Management Institute (IWMI) with the following partners:

- University of Essex, UK—J. Pretty
- International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)—S.P. Wani
- Centro Internacional de Agricultura Tropical CIAT) —M. Ayarza and N. Johnson
- Plant Research International, Wageningen, the Netherlands—H. van Keulen
- University of Tamil Nadu, India—T.M. Thiyagarajan
- International Water Management Institute (IWMI)—A. Noble, F. Penning de Vries, D. Bossio, C. Valentin, O. Cofie, M. Ul Hassan and D. Molden.

A ‘Bright Spot’ is defined as a community or group of individuals that achieves higher food and environmental security, through improvements in (among others) land and water management. ‘Bright Spots’ are potentially sustainable, and levels of natural resource capital are above ecological and economic thresholds in contrast to unimproved situations. In this project we are endeavoring to understand the key drivers (i.e., factors) that enable the development of ‘Bright Spots’, so as to develop strategies for their spread and replication. We have identified ten possible drivers that promote or influence the development of ‘Bright Spots’.

The objective of this questionnaire is to see whether these proposed drivers are valid, and we would be grateful if you would take 10 minutes of your time in completing the questionnaire. The questionnaire is made up of three sections:

A. General administration information

B. The impact of the project/initiative

C. An assessment of the key drivers

The questionnaire can be completed in two ways:

a) Handwrite your responses in the spaces below and fax it back to Andrew Noble (+66) 2-561-1230; or

b) Type in your responses in the space provided and e-mail the questionnaire to the following address: a.noble@cgiar.org

We are extremely grateful to you for your active participation in completing this questionnaire.

Section A

1. Name of project/initiative:. . . . . .
   . . . . . .
2. Contact person providing the information:. . . . . .
   . . . . . .
3. Address/e-mail:. . . . . .
4. Location of project/initiative:. . . . . .
   Location – Village/Community:. . . . . .
   Name of Town:. . . . . .
   Country:. . . . . .
   Latitude: . . . . . .
   Longitude: . . . . . .
   Mean Annual Rainfall. . . . . mm

Section B

5. When did the project/initiative start:

   and end:…….....

6. What was the total investment, including in-kind, (US$) in the project/initiative over the above period from external and internal sources i.e., NGO's, Donors, Government Agencies, Community funds etc.:

Source	Amount (US$)
Bilateral funding	. . . . .
International organization	. . . . .
National government	. . . . .
NGO	. . . . .
Community	. . . . .
Others (specify)	. . . . .
Please specify the source of funding:	. . . . .

7. Impacts on food output:

   Yields of crops and livestock associated before and after the project/initiative. Please feel free to add more crops and livestock, if necessary.

   Yields before or without project/initiative:

   Crop 1: name: …….. yield: ……. (t/ha)

   Crop 2: name: …….. yield: ……. (t/ha)

   Animal 1: species: ……... production /product: ……. unit: ……..

   Animal 2: species: ……... production /product: ……. unit: ……..

Yields after or with project/initiative:

Crop 1: name: …….. yield: ……. (t/ha)

Crop 2: name: …….. yield :…….(t/ha)

Animal 1: species: ……... production /product: ……unit: ……..

Animal 2: species: ……... production /product: ……. unit: ……...

8. What is the extent/uptake of the project/initiative?

Impact at the watershed level.

a) Percentage greenery in watershed before project/initiative:…….

b) Percentage greenery in watershed after project/initiative:……..

c) Number of trees established:…….

d) Percentage of the area impacted by the project/initiative:……..

Impact in terms of increased water availability.

a) Water availability before project/initiative:…….

b) Water availability after project/initiative:…….

c) Irrigated area before project/initiative (ha):……

d) Irrigated area after project/initiative (ha):…….

e) Cropping intensity:……..

Impact at the household community level.

a) No. of farmers/households that have adopted the 'Bright Spot' technologies:…….

b) Number of hectares under practices using the 'Bright Spot' technologies:……..

Section C

Which of these key drivers do you feel were important in both the development of the 'Bright Spot' and its continuance beyond the formal project period? Please address each of the drivers by ticking the appropriate box. 1 = strongly disagree; 5 = strongly agree.

Quick and Tangible Benefits

Immediate tangible benefits to the community or individual are an important requirement for the development of a 'Bright Spot'. For example, this may include increased yields within the first year of implementing changes; a reduction in the costs of labor etc.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Low Risk of Failure

Resource-poor farmers by their very nature are risk-averse, hence any changes that are made to create a 'Bright Spot' need to have an element of low risk.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Market Opportunities

In order for a 'Bright Spot' to develop, markets need to be present and assured to effect change.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Aspiration for Change

This reflects an internal demand by an individual or community for change that may be driven by faith or a wish to try something different.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Innovation and Appropriate Technologies

Innovations, new technologies and information are important key components in the development and continuance of a 'Bright' Spot'. This includes new skills and knowledge that contributed to the development of a 'Bright Spot'.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Leadership

In order for a 'Bright Spot' to develop and continue there is a need for strong leadership. This may include a single individual or group that champion change.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Social Capital

'Bright Spots' develop where there are community organizations, networks, and partnerships (private as well as public). This social capital also includes intangible aspects of social organizations such as norms and rules of behavior that can play an important role in promoting sustaining change.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Participatory Approach

'Bright Spots' require deliberative processes that actively involve the community in the decision-making process. This includes a strong element of learning and teaching.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Property Rights

For the development and continuance of a 'Bright Spot' secure (individual or communal) property rights are important to facilitate change.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Supportive Policies

Favorable changes in supportive policies at the local, regional and national levels are key drivers for the development and continuance of 'Bright Spots'.

	1	2	3	4	5
Development of the 'Bright Spot':					
Continuance of the 'Bright Spot':					

Are there any other drivers that were important in your project that should be included in this list? If so, please define them and indicate their level of importance as defined above.

Thanking you for your time and effort in making the above exercise a success.
Andrew Noble.

Postal Address: IWMI, P O Box 2075, Colombo, Sri Lanka **Location:** 127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka
Telephone: +94-11 2787404, 2784080 **Fax:** +94-11 2786854
Email: comp.assessment@cgiar.org **Website:** www.iwmi.org/assessment

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