



Representing the Plant Science Industry

# The Role of Agricultural Technologies & Biodiversity Conservation

A Collection of  
Case Studies

**THE ROLE OF AGRICULTURAL TECHNOLOGIES AND  
BIODIVERSITY CONSERVATION**

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# Introduction

## ENVIRONMENTALLY-SOUND INCREASES IN AGRICULTURAL PRODUCTIVITY

Biological diversity (biodiversity) refers to the variability among living things and the ecosystems they inhabit. It is key to ensuring continued life on Earth and is essential for sustainable agriculture and food production. Biodiversity is necessary to sustain vital ecosystem structures and processes, such as soil protection and health, water cycle and quality, and air quality. It also provides the genetic resources for the breeding of new, locally-adapted crop varieties.

Habitat destruction is one of the biggest threats to biodiversity. The patterns of human development - urbanisation, industrialization, conversion of land to agriculture, etc. - imply cutting down forests and clearing the wilds, with potential significant implications for biodiversity. Currently, more than 40% of the world's surface is used for agricultural purposes. As the world population grows over the next 30 years, agriculture will have to sustain an additional 2 billion people from an increasingly fragile resource base.

Improved productivity per unit area is more than ever required to sustainably meet the food, feed and fibre needs of the world's growing population. Technologies and products developed by the plant science industry; including crop protection products and enhanced crop varieties; help farmers to achieve this objective. Making farming more efficient and productive on limited land area, these tools are essential to prevent new land from being transformed for agricultural purposes.

Keeping new land from being farmed is only one aspect of biodiversity protection. Companies represented by CropLife International also foster a life-cycle approach

THE USE OF AGRICULTURAL TECHNOLOGIES INCREASES THE PRODUCTIVITY OF LAND ALREADY CULTIVATED AND THUS CONTRIBUTES TO BIODIVERSITY CONSERVATION.

to the management or 'stewardship' of their technologies and products in order to maximize benefits to the farmer as well as to protect and enhance biodiversity both on and off the farm. This approach begins during the research and development phase for crop protection products and new seed varieties, includes use on the farm, and extends through to disposal of any waste.

### Environmentally-sound R & D

The R&D-driven companies represented by CropLife International are constantly working to improve seed qualities and to research and develop more target-specific crop protection products, which also breakdown more readily in the environment. In the case of crop protection products, new product dose rates are now more often measured in grams rather than kilograms per hectare. Some biotech products also provide solutions to more targeted delivery of pest control agents. These and other measures enable farmers to increasingly make use of environmentally sound farming solutions.

New crop protection products require up to ten years of research and development before they are placed on the market. Before reaching the market, the products are exhaustively tested to ensure that they are safe to humans and the environment while still accomplishing their intended task. Safety studies for crop protection products cost up to US\$180 million prior to gaining regulatory approval. Failing any of the dozens of tests may mean the whole project is abandoned.

RESEARCH ON IMPACT TO NON-TARGET SPECIES IS A KEY COMPONENT OF PRODUCT DEVELOPMENT AND ENSURES THE ENVIRONMENTALLY RESPONSIBLE USE OF THE NEW PRODUCT.

Integral aspects of environmental testing include residue analysis and measurement and the tracking and analysis of product decomposition pathways within different crops, soil and water. It also includes research on non-target species from all types of environments: water, soil and air. A wide-variety of species are examined, including water plants such as algae; fish (cold and warm water); aquatic invertebrates such as daphnia; terrestrial plants; soil micro- & macro-organ-

POINTS OF CONVERGENCE BETWEEN AGRICULTURAL PRODUCTIVITY INCREASE AND BIODIVERSITY CONSERVATION GOALS NEED TO BE FOUND. THE WAY FORWARD IS TO IDENTIFY MUTUALLY COMPATIBLE PRACTICES THAT INTEGRATE BOTH GOALS.

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isms; terrestrial arthropods, such as spiders, mites, beetles, ladybirds, and bees; ducks and other birds; etc. All test organisms are selected based on their representation of related species, their handling possibility under experimental conditions and their ability to obtain representative test results. All trials assess the potential impacts of crop protection products under development. If risks can be managed, the label instructions highlight use restrictions to ensure the product's safe use.

### The effects of crop protection products on field fauna: not a black and white picture

Converting land to agricultural use often implies clearing of forests, leaving open and treeless surfaces in their place. This, along with other human development pressures, has resulted in the wild forest fauna being replaced by new fauna. Agricultural fauna is filled with valuable biodiversity that is continually influenced by farming practices. Although the use of crop protection products to control insects, diseases and weeds are often accused of contributing biodiversity loss, reality shows that despite their rather conspicuous effects, crop protection products are less responsible for biodiversity loss than may be anticipated – provided of course they are appropriately used and targeted.

With regard to insecticides, insects that move exclusively on the ground or even temporarily bore into it are less exposed to a sprayed product than those that cling to the plant. Strongly nocturnal creatures, which hide away during the day, are likewise less exposed. Seed treatment products, which work from the inside out of the plant, target pests that bore into the plant and leave other insects living in the crop unharmed. IT is also important to note that only a fraction of the entire field surface is treated with insecticides each year. The temporary loss of insects during this time is offset by their reproduction in the field or by their immigration to the field by foot or flight.

Herbicides are applied in the largest quantity and may have a noticeable effect on surface inhabitants because they alter habitat and living conditions. The effect of herbicides on biodiversity is essentially the same as with manual or mechanical weed removal. The removal of weeds by any means influences the microclimate within the field, including the incidence of light, temperature, and soil and air moisture. The increased free space is good for ground walkers, while other fauna lose their hiding places. Species that rely on the weeds for food may disappear. However, elimination of weeds remains a minor intervention for agricultural fauna, especially in comparison with the harvest, during which all vegetation is radically removed.

According to experts, other factors have a more lasting effect on the development of surface fauna from one year to the next. Agricultural mechanisation, crop rota-

tion or soil cultivation may cause much greater changes to field fauna than using crop protection products. For instance, the blade cultivator, which loosens but does not turn over the soil completely, has a gentler effect than the plough, which turns soil organisms upside down and destroys the soil structure.

Of course, the presence of non-cultivated is essential for increased biodiversity levels. Moors, heaths, copses and other moist and dry biotopes ranging from hedges to non-cropped field margins offer shelter to numerous fauna. The more these habitats exist, the greater their fauna variety.

### Environmentally sound land and technology management promoted

The management of sustainable, integrated farming techniques is also an important priority for CropLife International's leading companies. Technology packages and services are increasingly sought to address farmers' needs. This ensures that products are supplied along with proper support adapted to local situations.

Integrated Crop Management (ICM) combines care for a diverse and healthy environment with the economic demands placed on agriculture. An integral component of this farming strategy is Integrated Pest Management (IPM). IPM includes techniques for weed, pest and disease prevention through, for example, crop rotation and monitoring of pest populations against threshold levels. Direct control measures through biological, biotechnological, chemical and mechanical means may also be needed. The use of crop protection products is defined by targeted and optimized use, adapted to local environmental and economic conditions.

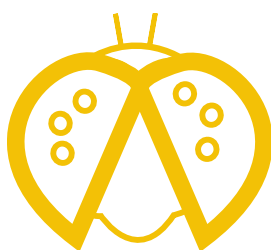
THE PLANT SCIENCE INDUSTRY IS COMMITTED TO INTEGRATED CROP MANAGEMENT, ICM. A BASIC COMPONENT OF THIS IS TO ENCOURAGE THE PROTECTION OF NATURAL WILDLIFE HABITATS WITHIN AND AROUND THE FARM.

# CASE STUDIES

The plant science industry helps to conserve and enhance biodiversity by:

- Making agriculture more efficient and productive on limited land area.
- Promoting land management systems such as Integrated Crop Management (ICM) throughout the world, and thus encouraging the protection of natural wildlife habitats within and around the farm. This is key for establishing a network of protected areas around the world as stipulated by the Convention on Biological Diversity. These areas include temporary, e.g. uncut, field margins, as well as permanent conservation areas.
- Researching on the impact of plant technologies on non-target species.
- Assisting with the management of invasive species, which is critical to an ecosystem's health.
- Maintaining seed bank collections, which help to ensure the retention of biological diversity for future generations.
- Supporting the appropriate implementation of international treaties, such as the Convention on Biological Diversity and the Cartagena Protocol on Biosafety. If properly implemented according to sound science and risk assessment principles, these treaties will help to encourage innovation, development and capacity-building for agricultural technologies that are necessary for sustainable agriculture, and achieving the goal of biodiversity protection.

The following case studies highlight some of the work done by CropLife International's leading companies in this regard.



## BIODIVERSITY CONSERVATION - AN IMPORTANT COMPONENT OF INTEGRATED CROP MANAGEMENT

Within the framework of Integrated Crop Management, CropLife member companies promote the establishment of temporary or permanent biodiversity conservation areas. Land management approaches such as conservation tillage also contribute to that goal. The following case studies highlight a few activities undertaken by CropLife members in various countries.

### 1. Conservation agriculture increases resources for wildlife

Reduced or no tillage as part of integrated crop and weed management are collectively described as conservation technologies or conservation agriculture. This land management system leads to improved food resources for wild animals such as deer and birds, since waste grain is not buried by tillage. The resulting mulch also provides an insect-intensive environment that again benefits many bird species. Researchers have found that quails can obtain their necessary Daily Caloric Intake in four hours per day in no-till fields, while it takes up to 22 hours per day in conventionally farmed fields. In addition the crop mulch left through conservation tillage also provides protective cover for wildlife. Earthworm populations have been shown to be higher under some reduced tillage systems. Conservation tillage reduces sedimentation of waterways caused by soil erosion by up to 90 percent and runoff of crop protection products by up to 70 percent, both leading to improved water quality in lakes, rivers and streams, which in turn benefit aquatic animal species. The demonstrable benefits of conservation tillage have led to widespread adoption of these practices in many countries, including **Australia, Argentina, Brazil, Chile, Paraguay, Canada, and the United States**. In Australia, for example, over 80% of all crops sown in 2002 used conservation systems.

### 2. The importance of keeping conservation areas on farms

A water and biodiversity conservation pilot project was launched in 2001 in **Brazil** by Bayer CropScience, the Department of Biological Sciences of the Sao Paulo



sites have seen 13 times more butterflies, 38 times more birds and over 3,000 bumblebees on habitat plots. The project is designed to provide new evidence about the value of creating wildlife habitats on farmland. It will also help farmers understand the new skills and knowledge required by the challenge of biodiversity. (The Buzz Project web site: <http://f-e-c.co.uk/Buzz/>)

## 6. Partnership promotes streamside buffers

The Illinois Buffer Partnership in the **United States** is a collaboration of private and public agricultural and conservation organizations to promote and showcase the voluntary efforts of farmers and landowners in the planting, maintenance and enhancement of streamside buffers. The effort was initiated by the Illinois Council on Best Management Practices and Trees Forever. Its sponsoring partners include Syngenta, Illinois' Department of Agriculture and Environmental Protection Agency and the US Department of Agriculture's Natural Resources Conservation Service. One hundred demonstration sites are planned by 2005, primarily on farms. Farmers and landowners will learn how buffer plantings of trees, shrubs, and grasses improve water quality, reduce soil erosion, and increase wildlife habitat.

## 7. A "Reforestation Project" plants over 450,000 trees

ECOAGUAS, a Syngenta led reforestation and water conservation programme in **Columbia**, seeks to preserve surface water sources and biodiversity. This programme is composed of various projects. The "Project for Integral Management of Hydrographical Basins" is carried out in conjunction with users of irrigation water. The reforestation part of the project established biodiversity conservation corridors in areas next to agricultural crops with the participation of the sugar cane industry, as well as the state highway reforestation unit. The projects are active in 49 locations in 14 municipalities of the Cauca Valley, Colombia. Thanks to all the activities developed during the last two years over 3,000 volunteers have participated directly, educating and benefiting over 300 families and 15 schools located in neighbouring areas. They are responsible for planting over 450,000 trees in the main river basins of the country, improved local understanding of water resource conservation and management, agricultural development and improved quality of life for communities in the Colombian South-West. It has protected hundreds of hectares for the conservation of biodiversity in forest areas and water sources, including those that protect water springs.

## INCREASING PRODUCTIVITY ON CULTIVATED LAND IS THE BEST CONTRIBUTION TO BIODIVERSITY CONSERVATION

The world's growing demand for food and improved food quality puts increasing pressure on terrestrial and marine ecosystems. The following case studies highlight a few activities undertaken by CropLife's companies in various countries that increase agricultural productivity.

### 8. Seed-treatment improves yield and protects beneficial insects

Whether vegetables, peanuts, cotton or other field crops, young plants are often threatened by early-season, yield-robbing seedling diseases. Protection of the plants from inside out through seed-treatment products is in fact the first line of defence to produce a strong, uniform plant stand, which sets the stage for increased plant vigour and exhausts their full yield potential - a key goal for all farmers. Seed-treatment delivered to the seeds early on not only often avoids repeated whole area spraying, which would affect insects and fungi in the crop repeatedly. This system is also a very targeted way of applying crop protection products, with regard to beneficial insects or diseases. In fact in many vegetable crops this application technology is one well suited for simultaneous use of biological control methods such as the use of predatory insects in greenhouses. Seed treatment products only control those insects or diseases that harm the plant through sucking, biting or invasion. While some have argued that this system is preventive and thus may sometimes result in unnecessary application, the benefits in terms of plant stand and protection of beneficials are clear.

### 9. Yield increase on land already ploughed is crucial to biodiversity conservation

In **Guatemala**, Bayer CropScience worked from 2001-2003 in partnership with the German government owned corporation for international cooperation ("Deutsche Gesellschaft für Technische Zusammenarbeit, GTZ)" and a number of local stakeholders to improve farmers' livelihoods by increasing agricultural productivity on existing farm land. Low productivity increases the demand for new land. In the project area, this situation resulted in high levels of traditional slash and burn practices, rapid agricultural encroachment into previously untouched forest reserves, and soil erosion and nutrient depletion, all of which jeopardized the region's unique biodiversity. The partnership particularly focused on improving productivity within two crops, tomatoes and peanuts, through an

ON MANY OCCASIONS MEASURABLE INCREASES IN AGRICULTURAL PRODUCTIVITY AND INCOME GENERATION ARE COMPLIMENTED BY QUALITATIVE SOCIAL AND ENVIRONMENTAL IMPROVEMENTS, INCLUDING REDUCED RATES OF AGRICULTURAL ENCROACHMENT INTO FOREST RESERVES, WHICH BENEFIT BIODIVERSITY CONSERVATION AT A LANDSCAPE LEVEL.

integrated, participatory training approach tailored to local needs. The results were impressive. Measurable increases in agricultural productivity and income generation were complemented by qualitative social and environmental improvements. Strengthened awareness and adoption of responsible crop management strategies enhanced livelihood security, including nutritional benefits derived from protein-rich peanut crops. This simultaneously reduced rates of agricultural encroachment into forest reserves, which benefited biodiversity conservation at a landscape level.

#### 10. Partnership raises funds to maintain crop diversity collections

To increase the productivity of crops and their reliability and nutritional quality, full use of the genetic diversity of the world's crop must be exhausted. Therefore practical ways of conserving this diversity are vital. The Global Crop Diversity Trust, a public-private partnership, was launched at the World Summit for Sustainable Development in 2002. It seeks to establish an endowment of US\$ 260 million to provide a permanent source of funding for crop diversity collections around the world, as well as to assist in the development of a rational and efficient global system of crop diversity conservation. Many of the world's crop diversity collections were opened during the 70s, when scientists believed that the race against genetic erosion was a race against time. These efforts led to the establishment of nearly 1500 collections of plant genetic resources around the world, holding more than 6 million plant samples. However a large number of the governments and organizations that established these genebanks did not make adequate provisions for their ongoing financial support. The campaign to establish the Trust has involved a partnership between the UN Food and Agriculture Organization (FAO) and the 15 Future Harvest Centres of the Consultative Group on International Agricultural Research (CGIAR). Syngenta and Dupont each pledged \$1 million for the Trust in 2004, which will serve as an element of the funding strategy of the International Treaty on Plant Genetic Resources for Food and Agriculture.

(The Trust's website: <http://www.startwithaseed.org/items/homepage.php>)

#### 11. Enhanced and high quality crop varieties increase productivity per unit of land cropped

For many years new crop varieties have been bred through traditional selection processes. The goal of all these endeavours is to improve crops in terms of yield, quality and pest resistance. Like many other agricultural technologies, enhanced seeds contribute

significantly to increasing productivity per unit of land cropped. Nunhems Chile, a subsidiary of Bayer CropScience is breeding new vegetables and melon varieties and produces their seeds, which are sold to many farmers worldwide. One of the competitive advantages of Chile for seed production stems from the country's unique geographic and climatic conditions. To the north Chile is cut off by the Atacama desert and to the east by the high Andean mountains. This has prevented some pests - like the key melon bacterial disease called fruit bludge - from spreading in the country and allows the production of healthy high quality seeds. Quality control checks of the harvested seeds follow national and international standards and assure that seeds are not only free of viruses, diseases and pests but also have an 85% germination capacity. In order to reach this high level, bees are an important service provider. They are kept in the cauliflower seed production fields and assure pollination that warrants germination of the seeds in the next generation. All these features are a key prerequisite for the subsequent production of a vigorous crop that contributes to exhausting the crop's production potential.

#### 12. Traditionally bred seeds or those bred through plant biotechnology contribute to yield increases

Whether crops are bred through traditional technologies or plant biotechnology the breeding goals in most cases include improved plant vigour, key to exhaust a plant's yield potential. Hybrid seeds - the basis of the green revolution - have increased yield on average by 20 to 30% since the 1970s. In a fitting tribute to the 2004 International Year of Rice, two breeders Yuan Longping of China and Monty Jones of Sierra Leone, have received the World Food Prize for their success in breeding hybrid rice seeds that today are used in many countries and contribute to a yield increase of about 20 percent over conventional varieties. A study by the National Center for Food and Agricultural Policy (NCFAP) says that the widespread adoption of six biotechnology-driven crops in 2003 increased farmers income, boosted yields and spurred greater use of non-tillage agriculture, which as indicated in the case study above is an environmentally friendly and also biodiversity

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enhancing agricultural land management system. The six crops are canola, corn, cotton, papaya, soybean and squash. The breeders working for the plant science industry and representing CropLife International, have contributed to breeding hybrid seeds and seeds enhanced through plant biotechnologies.

### 13. Increasing Productivity with Smart Alternatives (IPSA)

In many countries, agricultural land use hits wild biodiversity rich hotspots, resulting in land conversion at the expense of rare forests and wildlife species. In these cases it is crucial that the integrated goals of biodiversity conservation and increasing agricultural productivity are pursued. While many of the challenges relating to this situation go far beyond one single industry's or company's corporate responsibility, each one can contribute in its field of expertise to improve the situation. **Malaysia** is one of the biodiversity hotspots of the world and improving agricultural productivity on land already ploughed is therefore crucial. Initiated in 2003, a programme called "Increasing Productivity with Smart Alternatives" (IPSA) was developed through a public-private partnership between various Malaysian national institutes and organizations and Bayer CropScience. IPSA specifically intends to boost Good Agricultural Practices according to national and international standards within the overall concept of Integrated Crop Management, and to enhance safety measures during the application of crop protection products. During its initial 2-3 years, the nationwide campaign will focus on the oil palm plantation sector, following which it will expand its scope to include paddy vegetables and the fruit sector.

## INVASIVE SPECIES – A THREAT TO WILD BIODIVERSITY

Many thousands of cases of invasive species occurring throughout the world place a great burden on the non-native countries in which the species try to establish themselves. They are brought in from other countries and harm local ecosystems while threatening native species and leading to loss of biodiversity. Statistics indicate that imported plants and animals contribute to a worldwide annual loss of US\$ 400 billion. The man-

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THE MANAGEMENT OF INVASIVE SPECIES IS KEY TO ECOSYSTEMS' HEALTH. CROPLIFE MEMBER COMPANIES' PRODUCTS OFFER AN IMPORTANT TOOL IN THIS CONTEXT.

agement of invasive plant species is key to many ecosystems' health, and the use of crop protection products may be an important tool in this context. The following case studies highlight a few related activities undertaken by CropLife members in various countries.

### 14. Removing alien plants saves water and protects ecosystem health

One widely known example of an invasive plant is the water hyacinth. It was introduced from South America in the 1950s into many countries as a pig feedstuff. The species reproduced rapidly and spread over many countries, competing with other plants for space and water. In **South Africa**, a multi-stakeholder programme under the Department of Water Affairs and Forestry (Working for Water, WfW) was set up in 1995 to tackle the problem of invading alien plants. Over 150 species of invading alien plants exist in South Africa, depleting up to 10 % of the scarce annual water supply. These plants also pose a threat to the environment by crowding out indigenous plants, fuelling fires and endangering wildlife. The WfW programme has approximately 300 projects throughout South Africa and clears alien plants from 200,000 hectares per annum. To date, the bulk of efforts to manage these alien plants have used very labour intensive clearing methods. Some biological control programmes are in place, but they are insufficient to deal with the issue exhaustively. The programme is now also using CropLife International leading companies' herbicides, which have proved to be very useful in dealing with some of these invasive species. An important example is the water hyacinth, a plant that clogs natural water and irrigation systems in Southern Africa, as well as many other countries in the tropics and sub-tropics.

### 15. The mighty thirst of the invading Salt Cedar Tree

In the **United States** the Salt Cedar tree, which was originally introduced from Euroasia to prevent soil erosion near rivers and lakes, now threatens native plant species through its ability to absorb great quantities of water. In fact, one mature Salt Cedar plant may absorb up to 200 gallons (over 750 litres) of water per day. Where these have spread, rivers and lakes have shrunk. The problem is exacerbated by the fact that the plant's leaf glands excrete a saline solution that increases soil and water salinity. US Government agencies started a three-year experimental project along the Pecos River, which runs south through New Mexico and Texas. A BASF herbicide together with a state-of-the-art application technology has cleared some 2,566 hectares and over 200 kilometres of Salt Cedar, resulting in an estimated increase of over 60 billion litres of water flow in the river during the 2002-2003 season. The improvement in water quantity and quality has also protected the Pecos River pupfish from becoming endangered, and the

cleared areas have seen a marked increase in wild biodiversity.

### 16. Stopping tropical Soda Apple in Florida

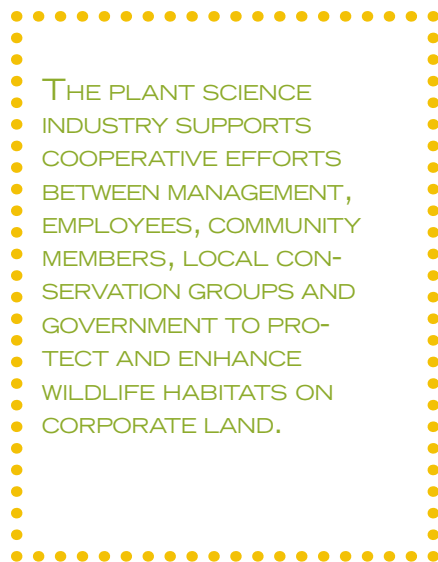
Tropical soda apple (*Solanum viarum*) is an invasive weed that has spread through more than 500,000 hectares of pasture in the state of Florida alone, crowding out desirable native forage species. The widespread coverage of this weed is a result of both natural pollen movement and dissemination by animals such as cattle, which ingest its sweet smelling golf-ball-sized, yellow fruit. Although the plant has thorns and a prickly skin, cattle will reach into the plant with their long tongue and remove the mature fruit from the plant without getting injured. As cattle are moved to other states for winter feeding or slaughter, they transport ingested seeds with them, resulting in the seeds being spread via composted manure, grass seed, sod, or hay. Dow AgroSciences is developing a new herbicide to address this and other noxious weeds that adversely affect the biodiversity of range and pastures. This herbicide will effectively provide long lasting residual control of tropical soda apple, spotted knapweed, yellow star thistle and many other invasive species at use rates as low as 35 grams per hectare.

### 17. Controlling Acacia in Southern Africa

Invasion of exotic trees and shrubs in rangeland areas of **South Africa** such as the Fynbos Biome pose a severe threat to plant and animal diversity, with negative environmental consequences such as alteration of soil nutrient cycling, reduction of runoff, increased river bank erosion, and reduction of light to the forest floor. One of these exotic trees is the acacia (*Acacia spp.*), which has dominated areas to the extent that natural vegetation has been almost lost, thus reducing the diversity and cover of indigenous plant species. The acacia is a tree with very deep roots that allows the plants to reach and use much of the available water and reproduce to the extent that it is difficult for animals to graze and roam the land. In South Africa and Namibia, herbicides developed by Dow AgroSciences have been used with success to control acacia such that previously unusable land has reverted back to its original use.

## CORPORATE LAND USED TO BENEFIT BIODIVERSITY

The Wildlife Habitat Council (WHC) is a group of corporations, conservation organizations and individuals dedicated to protecting and enhancing wildlife habitat. Created in 1988 in North America, WHC helps large landowners, particularly corporations, manage their unused lands for the benefit of wildlife. Corporations often own large tracts of valuable land that can be managed for habitat without affecting their operations. Through WHC-assisted projects, over 800,000 hectares in 48 states of the United States, Puerto Rico and fifteen other countries are managed for wildlife. Over 120 companies are WHC members, including BASF, Bayer, Dow, DuPont, Monsanto and Syngenta. Projects on these lands are corporate-driven cooperative efforts between management, employees, community members, local conservation groups and local, state and federal agencies. For more information on the case studies below and additional Wildlife Habitat Council certified sites that CropLife International's leading companies have developed, visit [http://www.wildlifehc.org/registry\\_certifiedsites/index.cfm](http://www.wildlifehc.org/registry_certifiedsites/index.cfm)



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### 18. Habitats improved by increasing vegetation and organic material

BASF employees and volunteers working to improve habitat on Fighting Island in **Canada** have made a conscious effort to maintain and improve the quality of the natural resources on and around the site while providing quality services to its customers.

Habitat projects on the 500 hectares island have included planting over 140,000 trees and seedlings, primarily poplar and Norwegian pine. In 1982, 30% of the beds were covered with vegetation; today approximately 80% of the island is covered with vegetation. Site employees placed thousands of bales of straw, hay and alfalfa and scattered seven years of leaves from the nearby town of LaSalle to increase the amount of organic material incorporated in the soil. They also introduced 300 turkeys and 5,000 ring neck pheasants to the island habitat. Recently developed projects include the conversion of existing runoff canals into marshlands, control of invasive weed species on existing man-made marshes, habitat management for migratory bird species, and the addition of habitat components for cavity-nesting species.

### 19. Partnership recognized for commitment to watershed restoration

The Three Rivers Habitat Partnership has promoted wildlife management on over 1,000 hectares on 20 corporate sites in southwest Pennsylvania, United States by encouraging corporate environmental stewardship and providing the knowledge and resources for individual landowners to do the same. Bayer Corporation's involvement in this Partnership has included hosting the Three Rivers Habitat Partnership office, placing and monitoring over 50 bluebird boxes (which have given rise to over 70 bluebirds hatched annually), eliminating mowing on over 8 hectares of its corporate land, expanding a bluebird trail, creating a Wellness Trail with interpretive signs, and planting three native wildflower gardens. In 2002, this Partnership was awarded a prestigious Governor's Award for Watershed Stewardship, in which it was one of only 24 organizations from across Pennsylvania to be recognized for its commitment to watershed restoration and environmental protection.

### 20. Tidal wetland management enhances habitat for local wildlife populations

The Dow Chemical Company's property in Pittsburg, California, **United States** encompasses approximately 190 hectares, 100 of which are actively managed for local wildlife populations. Of these 100 hectares, 70 hectares consist of a tidal wetland named the Dow Wetlands Preserve. Habitat enhancement activities on the preserve are discussed, designed and implemented by the 30-person Wetland Environmental Team and typically include planting native trees, shrubs and wildflowers throughout the property, improving the availability of nesting sites for native and migratory birds and regular wildlife monitoring. Team members also created a bird forage field to attract additional birds to the preserve. Other projects include building a wildlife-viewing platform, placing additional birdhouses, road improvements, cleanup programs and enhancing educational and recreational opportunities on-site. This project was awarded WHC's "Corporate Habitat of the Year" Award in 2000.

### 21. Wetland refuge for over 1,000 water birds restored

DuPont Company's 350 hectares Asturias Site is located along the banks of the Alvarez River on the Atlantic Coast of northern **Spain** and consists of wetlands, old fields and woodlots. The site was previously used for agriculture dairy production and as a eucalyptus plantation. The DuPont wildlife team, with the assistance of local organizations, implemented several wildlife enhancement programs aimed at improving existing habitats, reintroducing extinct ones and, in general, increasing biodiversity. The pinnacle of the habitat enhancement projects is the restoration of the "La Furta"

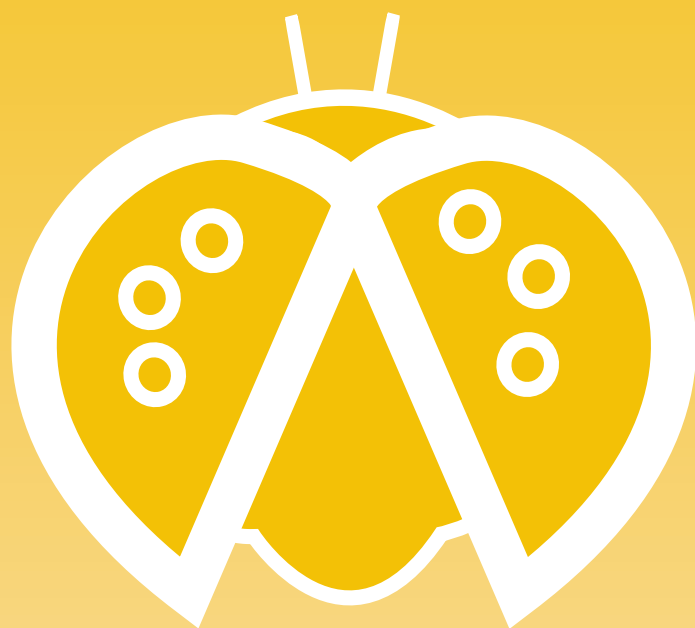
wetland. These 6 hectares of lake and marsh provide refuge to over 1,000 water birds, including a variety of species that are considered to be extremely rare. The DuPont Asturias Site received a special award from the American Birding Association in recognition of the site's exceptional treatment of birders who regularly visit the area.

### 22. Native flora and fauna at company headquarters increased

Monsanto's World Headquarters site is located near St. Louis, Missouri, **United States** on approximately 115 hectares. The open space consists of woodlands (approximately 40 hectares), grasslands (12 hectares) and manicured lawns (40 hectares). The mixture of wooded areas and open meadows results in a diversity of habitat that is reflected in the species found on-site, including coyote, wild turkey and white-tailed deer. The four primary goals of Monsanto's habitat enhancement program are to increase and enhance the quality and diversity of native flora, to increase the diversity of native fauna, to protect and enhance the existing hydrologic systems and to raise employee awareness about habitat enhancement activities and environmental issues in general. Specific activities include conducting controlled burns of previously established wildflower meadows, planting several acres of native prairie, developing a peregrine falcon release programme in partnership with the World Bird Sanctuary, and erecting and monitoring nest boxes for eastern bluebirds. The wildlife team also devised a Wildlife ID card, which enables employees to report wildlife and habitat observations. Completed cards are submitted to the site inventory database via internal company mail.

### 23. Wildlife habitat and environmental education opportunities enhanced

Syngenta's 500 hectares St. Gabriel Facility in Louisiana, **United States** has 240 hectares available for both wildlife habitat enhancement and environmental education opportunities. An Employee Environmental Committee focuses on enhancing and maintaining an on-site nature trail, continuing and expanding on nest monitoring efforts, monitoring reforestation projects and adding additional plantings to augment natural succession of the forest and open lands on the property. The 1.5 kilometres nature trail provides educational opportunities for the community and local school groups. The team added educational signage to the trail, such as species identification plaques to identify the native trees located along the trail. Team members purchased and planted "Millennium Trees" from a local arboretum to celebrate the year 2000. Also, an educational brochure was created about the nature trail and was made available to site employees at the entrance of the trail during Employee Environmental Committee sponsored Nature Walks.



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