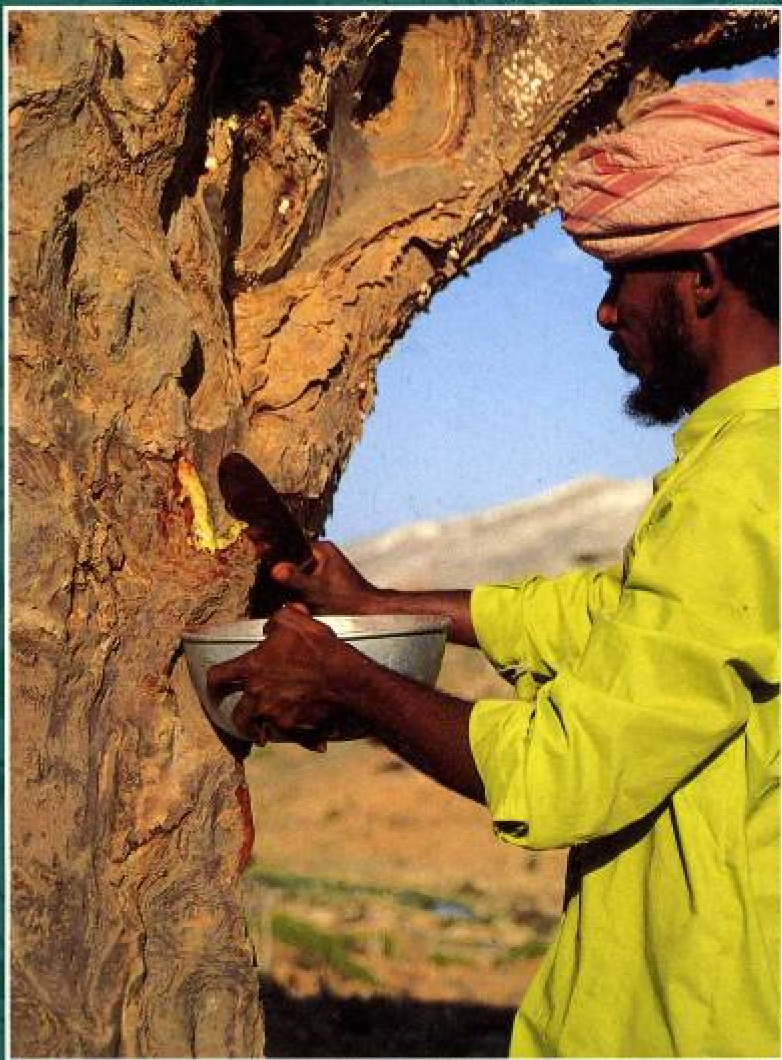
PLANT TALK

PLANT CONSERVATION WORLDWIDE



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PLANT TALK

NEWS AND VIEWS ON PLANT CONSERVATION WORLDWIDE

Issue No. 7, October 1996

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FRONT COVER: Gathering dragon's blood resin on Socotra (pp. 19–22). Photo by Diccon Alexander.

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Design for
PLANT CONSERVATION

BRENT INGRAM explains how to set the boundaries of a nature reserve for plants

Just as theré are well-designed houses that are safe and enjoyable places in which to live and there are badly designed houses which bring misery and hazard, so too is design necessary for effective nature reserves, parks and other kinds of protected areas. Unfortunately plants have too often been ignored or discounted in the planning and design of conservation areas, and this can lead to disastrous consequences for the survival of many plant species. Yet techniques to design nature reserves for plants are becoming increasingly diverse and complex. It is time to take stock of and promote this growing 'tool box' of approaches.

People have conserved plants for probably as long as they have used them. In India and China, sacred groves have existed for millennia as sources of medicinal plants and seed. Even further back, certain places were taboo to visit, inhabit or damage, closely linked to religious and community customs. 'Design' here was incremental, with decisions about the size and boundaries of these sanctuaries made slowly over generations. The colonial period and industrialization undermined and discounted earlier traditions and valuable local knowledge. In the latter half of the 19th century, the National Parks movement marked the beginning of modern conservation but, despite its good intentions, the emphasis on large mammals and wilderness panoramas has not provided effective protection to the full array of plant communities, species and genes.

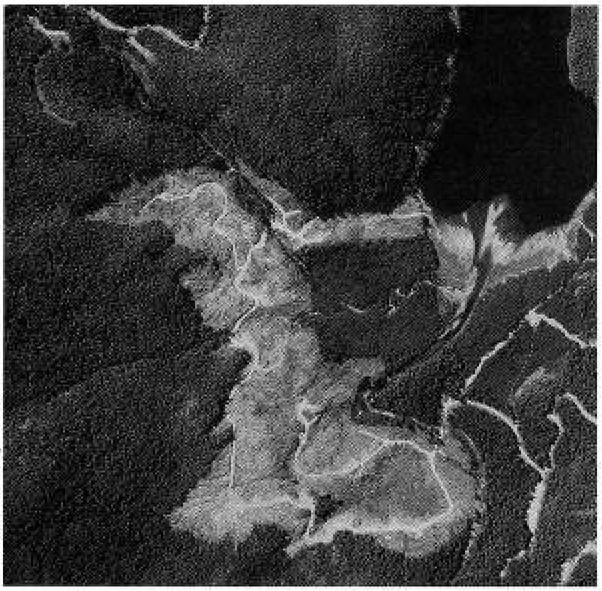
The emerging role of conservation biology

In the last three decades, more sophisticated means have emerged to conserve vegetation and biological diversity in networks of protected areas. These aim to protect all plants and animals 'equally'. Otto Frankel in Australia and Michael Soulé in the USA have been leaders in setting more precise conservation objectives for nature reserves and showing how the choice of objectives affects decisions on location, size and management. Known as 'conservation biology', this new approach focuses on life histories, minimum viable population sizes and landscape processes. The key ingredients of conservation biology are the organism, the ecosystem and the specific characters of the site and its broader landscape. Generalizations tend to be debunked – for example we no longer assume that what might conserve certain animals will ensure the long-term survival of all associated plants.

Paradoxically, by showing how to conserve some species more securely, conservation biology can lead to inadequate protection for other species. 'Favoured' species tend to be preserved because science or economics suggests that their conservation is particularly lucrative, useful or strategic. The problem is that these chosen species often change. As conservation priorities change, so too do the requirements for the minimum size of a nature reserve and its boundaries and management.

Clarifying goals and objectives

So, before designing a nature reserve for plants, we have to be clear on the objectives. Which species do we want to ensure survive? Do we want the area, or part of it, to remain a grassland or to change through



British Columbia Ministry of Forests

Fragmentation of a temperate rainforest, at Tofino Creek, Clayoquot Sound, Vancouver, 1990. Except for the square reserve (centre), nearly all of this area has since been destroyed by clearcut logging. The square remaining is too angular and too isolated to be a good reserve design.

Some common sense principles for planning nature reserves

No reserve is an island. Each protected area must be viable on its own, but long-term success inevitably involves links to nearby conservation areas. Reserve boundaries must be set in terms of a broader, district-wide network of protected areas and management zones.

Scientific and social information is vital. A protected area is only as effective as the data, theory and projections that went into its design. Research must always precede planning and design.

Everything will change. Science is in perpetual flux, so a design appropriate in 1996 may well need to be altered by 2006 or 2016 as more data and projections are available.

Never design a protected area without conducting some of the field work yourself. Too many decision-makers have missed practical details because they were never on-site.

Plan comprehensively but expect endless fine-tuning. Nature reserve boundaries are meant to be expanded. Avoid loss of reserve areas at all costs, but expect to need to expand the reserve and connect with other reserves in future. Avoid making commitments **not** to expand and connect reserves.

Target whole communities, successional phases and ecosystems for protection rather than a small number of species. Rare and threatened species often need special or immediate attention, but if the broader requirements for their ecosystems are not included in designs, reserves will not be viable in the long term.

Incremental additions to nature reserves are inevitable. 'Master plans' are not forever. Muddling with slow expansions over time is often more cost-effective in terms of staff, fiscal and political 'capital' than spectacular solutions that are difficult to afford or implement, and may be resented by some sectors in society.

Confront animal conservation biases with vigilance, humour and panache. Early on, any assumption that effective plant conservation automatically follows animal conservation must be uncovered and tactfully confronted. Expect to provide basic information on plant species and their conservation requirements and to emphasize their comparative importance.

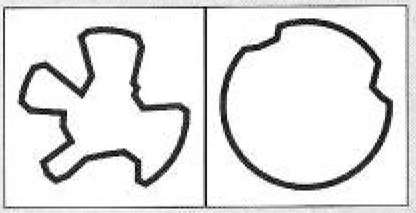
Ownership and jurisdiction aspects of a reserve design are less important than the levels of cooperation. As was learned in Britain years ago, effective conservation can involve a patchwork of jurisdictions and ownerships if there is the will to protect wild plants. In contrast, plant conservation in areas owned by a single public agency, as often occurs in North America, can be ineffective without institutional will and coordination.

Neighbour cooperation is essential. Until all neighbours are 'on board', through at least a vague commitment to conserve some habitat or species, there is no point in going to the trouble of carefully mapping an optimal reserve boundary.

Emphasize a range of long-term human needs for plant conservation rather than short-term economic utility. The last two decades have shown us that rationales for conservation centred on market values alone, such as for genetic resources or pharmaceuticals, lead to incomplete protection and often fail to convince the public. There are many reasons – social, ethical and aesthetic – to conserve plants. Market indicators and money values provide only a partial picture.

Figure 1

Area to boundary ratio

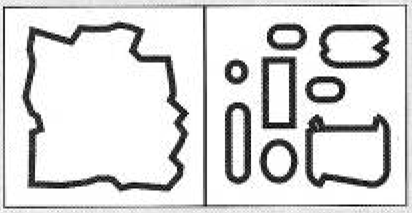


Less good **Best**

The greater the length of the edge of a reserve in relation to its area, the greater the need to regulate land-use in the surrounding area.

Figure 2

Single large or several small reserves

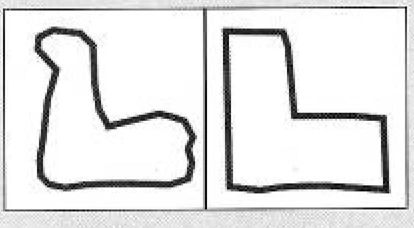


Easier to manage **More difficult to manage**

One large reserve is often less vulnerable, easier to manage and requires less restrictions on adjacent land-use than several smaller ones. But, several smaller ones may be needed to cover all the plant communities, species and genes needing protection.

Figure 3

Follow natural landscape units



Best **Less good**

Reserves with boundaries that follow natural landforms and landscape processes, such as patterns of succession, tend to be more viable than ones that have straight lines as boundaries.

natural succession into woodland? What do local people want from it? These are the sorts of questions that have to be answered. Behind every conservation decision is inevitably a bit of favouritism for particular populations, species and ecosystems. A network of reserves should be a balance so that no species or habitat is dangerously neglected.

In most nature reserves, the boundaries are very porous and the total areas are too small to be viable in the long term. Here, the objective should not be to see the reserves as isolated ecological islands, but rather to see their boundaries as a membrane that links natural core areas through buffers of less natural but regulated areas to the surrounding landscape. No reserve is an island but rather part of a network.

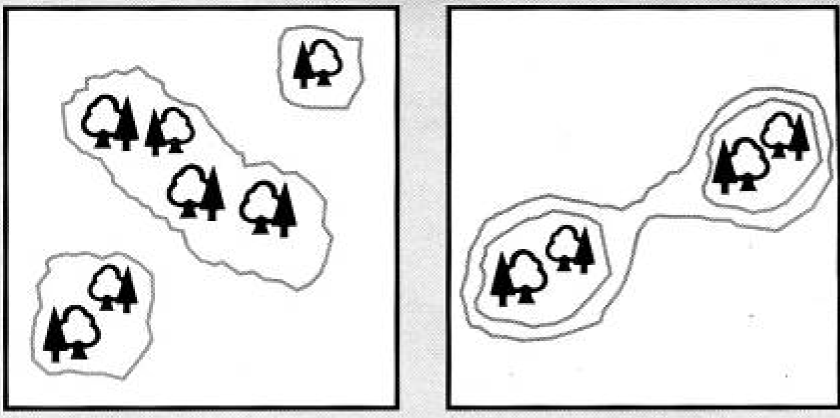
There is always more than one way to conserve plant diversity and most nature reserve decisions involve various 'trade-offs' with the short- and long-term needs of local people. For these reasons, one of the most difficult aspects of designing nature reserves is setting boundaries that will fit in as far as possible with shifting political circumstances.

By recognizing as many possible trade-offs as possible, there are better chances of finding a 'scenario' that might work, including regimen, boundaries and regulations. It is important to make these assessments as early in the design process as possible. I would suggest that many species, even rare or endangered ones, may be more adaptable and able to persist in a range of conservation regimes than can the adjacent human communities with their growing economic expectations.

The next step is to choose the best strategy for the reserve concerned. The choice here might be between a single large reserve that would not require much management but might be costly to establish, and a set of small scattered reserves that might be cheaper to create but would require the land uses in the surrounding areas to be tightly regulated. Because a nature reserve is never truly an island but is vulnerable to adjacent land use, pollution and introduced species, it is better to agree on an overall strategy before settling the boundaries.

Figure 4

Some nature reserve designs for particular conservation objectives



A. **Rare and endangered species.**

If only a few populations and natural habitat remain, it may be necessary to include all fragments of natural habitat regardless of their condition and to apply a high degree of management to them.

B. **Rare species in a rapidly dwindling habitat.**

The sites of rare and endangered species can provide the cores of larger conservation areas and act as powerful anchors for conservation of a broader regional ecosystem.

The process of design

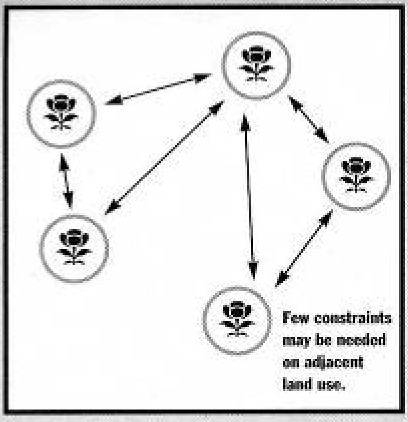
With the objectives and strategy in place, we can begin to consider the more technical aspects or "design criteria" and so determine the overall location and shape of the reserve. Reality comes in to play. First, there is often the bleak fact that little remains of the natural habitat to support a particular plant species. Where habitat is being rapidly destroyed and there is little time for surveys, as for

Brent Ingram

Tropical rainforest, Siberut Biosphere Reserve, Indonesia. Many forest perennials occur in low population densities. Reserve design must include sufficient population sizes and large mosaics of highly dynamic successional phases.

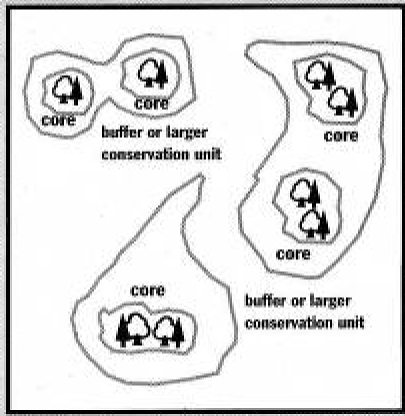
C. **Wild plant genetic resources, including wild crop relatives.**

At least one large, contiguous population across a range of environments is needed to maintain resilience, fitness and rarer genes. Such a reserve should be placed near the centre of the species' distribution. Many smaller populations on the ecotypic extremes (e.g. one at its highest altitude, ones at the edges of its natural range) should be protected as well, since these will maintain the rarer genes and the populations most subject to evolution through natural selection.



D. **Annuals with sufficient habitat that they are not rare or endangered. (Reserves often used to provide seed.)**

Many relatively small areas may be sufficient to maintain fitness and resilience scattered across the distribution of the species.



E. **Perennials with sufficient habitat that they are not rare or endangered. (Reserves often used to provide seed and cuttings.)**

Perennials in complex successional mosaics often occur in such low densities that a combination of several cores connected by large areas of buffer may be necesssary. The cores are for mature individuals in less disturbed conditions, while the buffer guarantees sufficient edges and 'pioneer' phases for younger individuals.

example in large parts of tropical Asia and Latin America, centres of diversity such as Pleistocene (Ice Age) refugia can be chosen as 'good bets' to conserve a large number of plant species.

Conservation biology now offers techniques to translate precise objectives into effective designs on the ground. It can tell us, for example, the minimum size and number of populations needed for long-term survival, to insure the species can combat natural disasters and have sufficient genetic variation to adapt to changing conditions. It can predict how the vegetation might change through natural succession and how it might be affected by external factors like air pollution.

There are many ways to design a set of reserve boundaries with buffers and internal management zones. Approaches can be chosen that reflect the level of knowledge, the vulnerability of species, the external threats and the technical capabilities of the conservation planning group. Acceptable levels of risk can be set. And there are many new ways of adapting the initial, optimal conservation designs to socio-economic realities.

Finally drawing the lines

Taking the plunge and actually proposing a line and a set of properties for conservation is often highly politicized and nerve-wracking. In much of Europe and North America, such lines tend to be drawn by inter-agency 'working groups' or committees within NGOs. I have seen people spend weeks arguing over one boundary line – for good reason. Not surprisingly, after months of research and a rational planning process, the 'design' can be difficult to explain. Luckily, bad lines have a way of being redrawn over and over again. The key is to record the logic behind every decision even to the point of citing the models and data used and the key scientific articles and reports.

The various boundaries drawn around and across plant preserves are alive and will probably change over time. Design is just one part of a broader process of human communities coming better to know and respect natural ecosystems. One can see the lines as artefacts reflecting what we know and cherish and what we do not know and choose to neglect at a particular point in history. Inevitably they will evolve as will our efforts to become effective stewards of the lands on which we live.

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