Case Study: LENZ Classification

1 What is LENZ?

1.1 LENZ is a derived database and environmental classification that identifies climatic, landform and soil factors influencing the distribution of species and uses these factors to group sites with potentially similar ecosystem character. It uses data originally collected as discrete databases and layers and integrates them for use as a predictive tool. Some of the original data was FRST-funded, while much of it pre-dated the setting up of FRST and the CRIs. LENZ thus makes FRST funded research results more accessible and useful.

1.2 LENZ is different from traditional ecosystem classifications which use qualitative synthesis of multiple information sources. LENZ uses modelling techniques to classify New Zealand into broadly similar environments. By classifying sites into similar groups, LENZ therefore enables prediction of the broad character of sites that have been substantially modified by land use change or introduction of pests and weeds.

1.3 While originally conceived as a tool for biodiversity conservation, it has wide application for ecological restoration, biosecurity, risk management, public health and economic development through agriculture, horticulture and forestry.

1.4 The value of LENZ has been demonstrated through:

- Its use by the viticulture industry to find new fine wine grape growing areas;
- through its use to confirm findings from earlier cruder studies that showed that low-lying environments had the worst biodiversity conditions and were subject to the highest threat of further loss, being mostly on private land and having low levels of legal protection. DOC subsequently refocused its policies towards low-lying ecosystems.

1.5 The LENZ products comprise;

LENZ books

- *Land Environments of New Zealand-Nga Taiao o Aotearoa* ($49.99 from Manaaki Whenua Press)
- *Land Environments New Zealand Technical Guide* (free from MfE)

LENZ Data

- *Land Environments of New Zealand Underlying Data Layer*
  - Public Good License: $350
  - Commercial License $1500 + royalties/profit sharing if included as part of another application/product
- *Land Environments New Zealand Classification Layers*
  - Public Good License: $350
  - Commercial License: $1500 + royalties/profit sharing if included as part of another application/product
- Purchase of the underlying data and the classification at the same time costs $2500 for a commercial license

All prices shown include GST

1.6 A website http://www.landcareresearch.co.nz/databases/lenz/index.asp provides additional information and tools related to LENZ and a public email list (106 subscribers as of October, 2006) to keep end users informed about LENZ.

2 What were the issues?

2.1 The LENZ case study illustrates a number of issues that affect the accessibility of the FRST funded public good research results:

- It was funded by parties other than FRST to make the base information more useful
- Co-funding and IP issues affected the access and usability (in this case LENZ's dissemination and updating)
- There was a substantial investment over and above the FRST funding for research to make the information more accessible and usable

2.2 This case study also highlighted a number of wider issues that affect the accessibility of databases and tools derived from them:

- How should derived databases be funded?
- How should the maintenance and updating of such databases be funded?
- How should the updating of the underlying data for the derived database be funded?
- Who should own the derived data?

See below for discussion of the issues.

3 History and development of LENZ

3.1 The government (through the Foundation, the former DSIR and government departments) has, over a number of years, funded the collection and mapping of a range of discrete climate, soils, landform, land use and vegetation databases.

3.2 Dr John Leathwick conceived the idea of the LENZ classification while at Landcare Research, and carried out early research on conceptual approaches and methodologies in the FRST-funded programme: *Methodology for Selection of Biodiversity Indicators* programme 1996-2000. This formed the platform from which LENZ was developed.

3.3 The Ministry for the Environment needed a tool to monitor and report on ecosystems within the context of both the Resource Management Act, and the Ministry's emerging Environmental Performance Indicators Programme. As a member of the advisory group on the biodiversity indicators programme, the MfE saw the wider application of the LENZ idea.

3.4 With regional council support, in the late 1990s, the Ministry contracted Landcare Research to, first pilot LENZ in Waikato, Wellington and Canterbury, and then in 2000-2002 to fully develop the LENZ derived database and classification. DOC provided in-kind support through a staff secondment to assist in the conceptual development and to facilitate the trials and the implementation.

3.5 During the development phase, 15 underlying data layers were generated as building blocks for the development of the classification. The climate layers came from mathematical interpolation techniques using data from long-term Meteorological Service weather stations. The landform layer came from a digital elevation model generated from 1:50,000 topographic data sources and the soils layers came from the Land Resource Inventory. The National Vegetation Database was used to relate the distribution of New Zealand's major tree species to the climate, landform and soil variables. Those variables with the strongest relationship with tree distribution and tree growth processes were selected for the LENZ. All layers were derived from

base data held by Landcare Research, with the exception of the climate layers, which were public domain NZ MetService publications.

3.6 This input data (soils, climate, and landform) existed in a variety of paper and digitised forms. The base climate data was derived from the New Zealand Meteorological Blue Book of long term (1950s-1980s) climate data. Landcare Research had previously digitised the soils information supported by its own funds, and MfE contracted Landcare Research to update this soils information.

3.7 The LENZ products were released in 2003. Initially only 8 regional councils and 4 district councils purchased LENZ. Following MfE purchasing LENZ for all councils in October, 2004, it became accessible to them all.

3.8 Maintenance of LENZ since 2003 has involved the following;

- A Landcare Research support team for regional and local users
- Development and maintenance of the LENZ website, including:
  - An online ordering system for the LENZ data
  - A news and updates service
  - A downloads area for tools, reports, and other relevant information
  - A password-protected area where licensed users can download updates or other information
  - Management of user queries and an e-mail discussion group
- A LENZ sensitivity analysis for its use in the FRST-funded Biodiversity and Threatened Species Programme
- Data compatibility support to users
- Development of an electronic version of the LENZ technical guide
- Development of tools such as Environmental Distance and Threatened Environments
- LENZ regional workshops (16 held with 300 attendees from over 100 organisations)
- Publication of a range of information (newsletters and presentations)

4 How was LENZ funded?

4.1 Development funding for LENZ consisted of the following:

- FRST-funded research and research funded prior to the setting up of FRST and the CRIs underpinned the development of the data layers and classification comprising LENZ. For example, the Land Resource Inventory, soils mapping across NZ, the National Vegetation database (all of which had significant government investment, in the order of several millions, over several decades). The FRST-funded *Methodology for Selection of Biodiversity Indicators* programme, 1996-2000, was the vehicle for development of the environmental classification and the catalyst for LENZ; $125,000 of this programme, over two years was allocated to LENZ)
- MfE and Environment Waikato funded regional trials for proof of concept for LENZ to the level of around $300,000
- MfE funded the implementation of the national classification over 2000-2002 ($900,000). In total, MfE funded $1.2m for the classification methodology development
- DOC provided in-kind support through a staff secondment to assist in the conceptual development and to facilitate the trials and the implementation and uptake within DOC

- Landcare Research provided $50,000 for marketing/business development for one year (2002/03) and had, prior to LENZ, funded the digitising of soils information.
- Ministry for the Environment paid $80,000 for the updating of the soils information

4.2 Following the public release of the LENZ products, funding consisted of;

- LENZ CD licence sales- 100% of sales revenue was put towards LENZ maintenance, including $63,000 from MfE for purchase of local council licences in 2004. Landcare Research has absorbed losses in 2004-2006 to continue support for LENZ;
- Funding to set up the distribution system, marketing and education, from Landcare through NSOF 2002-2004 ($60,000 pa) and from several Landcare Research programmes in the order of 100 hours of individuals' time over the life of the LENZ development;
- DOC Biodiversity and Threatened Species Programme-LENZ sensitivity analysis (2003-2005);
- The FRST funded Land Resource Inventory Survey (LRIS) programme supported corrections and updates by three Landcare Research staff (2003-2005);
- The FRST funded Spatial Information SPINFO Programme supported corrections and updates (2004-2005)
- Regional workshops co-funded by the DOC Terrestrial and Freshwater Biodiversity Information System (TFBIS) programme, and Landcare through the NSOF funding mentioned above;
- Since 2004, MfE, DOC and LINZ have funded a series of studies undertaken by Landcare Research using LENZ as a spatial framework to evaluate the representativeness of biodiversity protection measures;
- A current EnviroLink project ($105,000) to enhance uptake and use of the Threatened Environments classification.

5 How was it managed?

5.1 LENZ was managed by a Landcare Research Senior Scientist until 2002/03 and then by a Landcare Research Scientist. An advisory group of users from MfE, DOC and Environment Waikato (associated with the *Methodology for Selection of Biodiversity Indicators* programme) advised on end-user requirements and implementation throughout the development and implementation of LENZ.

5.2 The MfE funding was provided under a contract to Landcare Research. The contract split the IP between MfE and Landcare Research so that MfE owned the LENZ classification layers while Landcare Research owned the classification methodology and the underlying new derived datasets. Landcare Research were granted an exclusive licence in the contract to keep all revenue from sales of the LENZ classification layers (i.e. MfE IP) and use it for maintenance of the LENZ over a 5 year period, at which point a decision would be taken to either roll the licence over or do a new version of LENZ. No provision was made for marketing LENZ once completed. This left a funding gap.

5.3 The Landcare Research Scientist currently overseeing LENZ is responsible for sales and promotion, user support, website development and maintenance, administration of the funding, and overseeing development of any corrections and updates. Sales were slow until a number of regional workshops were held in 2004. At this point, MfE bought licences for all councils thus boosting revenue, but still not to the level needed to maintain LENZ.

6 Accessibility Issues

Research institution context

6.1 The purpose of LENZ was to convert existing data into more accessible and useable products, compared with the discrete datasets from which the new data layers and classification were derived.

6.2 At this initial stage, there was little support from the Landcare Research management for the development of LENZ, for a number of reasons. LENZ was a new and innovative approach and somewhat outside the square amongst ecologists and regional councils due to it's layered, integrated and spatial approach at a broad scale. It was also competing for funding with more traditional science, and with science that could earn dollars. Its value was not yet proven.

6.3 The prevailing attitude from Landcare Research at the time was that if users wanted it, they should pay for its development. Collaboration across CRIs, which was needed to fully unlock the potential of LENZ, was difficult where there was a perception of competition, thus locking out effective collaboration. Scientists felt unable to influence priorities and the dollars went elsewhere as the Foundation aggregated the biodiversity indicators programme into a bigger programme in 2001. No FRST funding was available for ongoing development of the conceptual or applied work on LENZ, leaving the work stranded at a critical stage of its development: the initial conceptual work done but the classification not yet developed.

6.4 It should be noted, however, that Landcare Research management did support LENZ in its later stages, particularly during the critical dissemination and user uptake phase.

IP and Co-funding issues

6.6 The nature of the contract for the LENZ development was unusual. Normally when a government department contracts for a product, it keeps all of the IP, and MfE has done so more recently, for a similar product for water environments that it contracted NIWA to develop.

6.7 In the LENZ case, the MfE contract was for derived data layers and a classification. The IP for the data layers was in this case retained by Landcare Research, along with the IP for the classification methodology which was developed primarily via FRST-funded research and thus retained by Landcare Research in the normal way.

6.8 MfE retained the IP for the LENZ Classification but Landcare retained the exclusive license to on-sell the data layers and classification, with an agreement that they would direct all sales revenue towards maintenance and update of LENZ

6.9 Under the prevailing institutional context at the time, Landcare Research would not have agreed to anything but such a split of the IP. They put a high value on the underlying data which was used to derive the new LENZ database and which had been collected over many years by them and their predecessors. They saw the derived database as an extension of the original data. There was also potential to earn revenue from the products in the prevailing user pays context. Indeed the

expectation was that they could earn revenue from data and information when CRIs were first established[1].

6.10 When the data was originally collected (under the pre-CRI science system) there was very little idea of its future value for a derived database and classification. It was paid for out of the public good research fund and handed over at no cost to the CRI on its establishment. In this case however, value had been added to the data, in part funded by FRST (LENZ conceptual research), the CRI through NSOF and part funded by MfE for soils data updates. This co-funding arrangement served to confuse ownership of the underlying data.

6.11 Ownership became an issue in the LENZ case because the CRI and the user had different approaches to access. Landcare Research saw the products as a revenue stream to enable maintenance to occur, while MfE saw ownership as a means of making the products available to users free of charge. MfE took this view since it regarded LENZ as having been paid for out of the public purse, so it should be widely available at little or no cost.

6.12 However, for the original FRST- funded data to be fully accessible and useful, it required considerable new work, which arguably, could be charged at cost of production, but by the client (MfE) who substantially paid for the work. However, so long as the price was reasonable and the revenue was going into the updating and maintenance of the products, the issue of who owned the IP was a second order question. The more important issue is the *ongoing* maintenance and updating of the derived LENZ database and classification, to ensure the value of the investment is maintained.

Maintenance and updating issues

6.13 The splitting of the IP had the advantage of enabling some degree of maintenance of the products using revenue, but the market is small and revenue from sales are insufficient to maintain the products over time. Many councils felt that the cost of $700 for a public good licence for LENZ was too high, and so in order to get LENZ used, MfE purchased the products for councils, and reimbursed those that had already purchased LENZ. The remaining market is too small to sustain LENZ long-term and ensure that the base data, data layers and classification is updated when required. It is thus uncertain how the maintenance and updating of LENZ will be funded over time.

7 Accessibility success factors

7.1 The critical success factors for LENZ[2] included;

- Strong and visionary science leadership. John Leathwick had an innovative idea and was able to develop it through the FRST Biodiversity Indicators Programme to a stage where a user (MfE) paid for the idea to be developed and used by a range of users.
- A small team of Landcare Research staff who were committed to championing LENZ during the critical dissemination and uptake phase, running regional workshops to raise user understanding and awareness,

[1] Refer section 2.1 of the Synthesis Report for policies on the transfer of databases to CRI's when they were established

[2] LENZ was the means by which FRST- funded underlying data was made more accessible and thus useable by a range of users

developing the website to facilitate access, and presenting to numerous user groups interested in LENZ, usually at little or no cost.

- Landcare Research support for the team during the dissemination and uptake phase.
- Users who understood the value of the derived database and classification. Kirsty Johnston, with regional council support, drove the work with MfE funding for underlying data updates as well as the LENZ products
- A user willing to pay for it. Kirsty was able to get MfE funding for the development and implementation of LENZ
- The 16 workshops were critical in raising understanding and awareness of LENZ and its potential uses
- Trialling LENZ, which was an essential part of generating acceptance of its utility and thus making it accessible
- A team of scientists and users who communicated well amongst themselves
- Champions in other organisations, who assisted in maintaining the momentum to enable LENZ to be completed, e.g. DOC and Environment Waikato

8 Accessibility barriers

8.1 There were several barriers to the development of LENZ including;

- No funding is available for maintenance and upgrades and for underpinning research that could lead to the development of new versions over time or to improve the accuracy and resolution of the LENZ data layers. LENZ cannot be self-sustaining through sales revenue and needs ongoing support for this to happen
- Lack of Landcare Research management support at the early stages of the project made it difficult to develop LENZ (however much greater management support was given to the later dissemination and uptake phase).
- LENZ was a new idea and the weight of opinion was against it. LENZ required a paradigm shift in thinking about the use of data and information at broad spatial scales and its predictive power. LENZ challenged prevailing thinking of ecologists because it was broad and spatial in design and based on modelling
- Some technical issues around data format and software. Because different software platforms are in use across New Zealand, the LENZ layers had to be transferred to more accessible formats than the one in which they were originally created. These translation processes were an additional cost of dissemination.
- Ownership issues around the split IP. Retention of the IP and revenue streams from the sale of the new derived database by Landcare Research had the effect of creating a price barrier to access for some users. In addition the administrative arrangements for the sale of the products created additional work for the CRI that was not funded by the Foundation.
- No funding for proactive marketing of the products by MfE or other sources meant that other funds (license fees and Landcare Research NSOF) had to be found to ensure the products were accessible to users

9 The Foundation Draft Access principles

9.1 The Foundation's draft access principles are:

1. ***Public good primary results and codified information should be made available to the maximum extent possible at the cost of dissemination, so long as that access maximises the national benefit.***
2. ***Where possible, research organisations would identify in advance the public good outputs that should be publicly accessible.***
3. ***Disclosure by research contractors to the Foundation when release of public good outputs or primary results is denied and reasons for the denial.***
4. ***Provide for a dispute resolution and escalation process where there is a difference of views between the Foundation and research contractors over access to public good outputs***

There are several conditions where withholding or deferral of access could align with the national benefit. These are:

- ***a. Where release may result in loss of, or significant reduction in commercialisation opportunities and returns to New Zealand, including damaging commercial partnerships between research contractors and firms or industry groups;***
- ***b. Where the release may have significant adverse effects on the environment, existing New Zealand industry, or the cultural values of groups of people***

Comment on the above principles concentrated on Principle 1 and 2.

9.2 Having general guidance on access to public good science results and information was supported.

9.3 The Foundation's access principles would not have affected access to LENZ, but could have been applied to the FRST-funded underlying data and classification methodology, which fed into LENZ. However, these elements by themselves would not have been as useful as the LENZ, which has applied the input data to derive a new set of data layers and a classification as a powerful tool for decision-making

9.4 National benefit was viewed as difficult to define and some thought it could be used to maximise revenue from publicly funded outputs. MfE saw LENZ as environmental information and thus public good and not therefore for sale. However, they did support costs of dissemination being recovered.

9.5 Principle 2 was regarded as a good principle, but not workable in the context of LENZ, because the products that emerged could not have been anticipated at the beginning.

9.6 The major accessibility issue that arose from this case study around maintenance and updating of LENZ would not have been affected by the FRST principles since they relate to the lack of a systematic funding system for such public good databases.