a smaller effect on preserving nutritive value, but pre-
vented sample alteration and a loss of nutritive value
more so than transporting samples in a chilly-bin. This
is likely due to liquid nitrogen rapidly reducing plant
metabolic activity i.e. respiration and preserving mac-
romolecular structures (Pelletier et al. 2010).
Freezer temperature had less impact on nutritive value
than sample transportation or drying method, with little
difference between storage at -80°C or in a standard
freezer, except for NSC and ash. Storing samples in a
freezer better preserved nutritive value attributes
than storage in the chiller or at room temperature.
Across all the post-sampling procedures, nutritive value
preservation was poorest for chiller and room temperature
stored samples. When comparing chiller stored samples
to room temperature stored samples, the chiller best
preserved nutritive attributes but results were
inconsistent between years; and may reflect the
difficulty in controlling these storage environments.
Dale et al. (2016) compared storage of pasture samples
in a fridge at 4°C versus ambient temperatures and
concluded samples were best stored in a fridge and
analysed within 24 hours of sampling.
Access to liquid nitrogen and a freeze-drier to obtain
accurate estimates of nutritive value may be limited to
those undertaking scientific research; an underestimate
of nutritive value may therefore be inevitable for
more basic sampling practices. However, it is often the
relative nutritive values of forage samples that are
required rather than an absolute estimate, for example,
when ranking the nutritive values of different ryegrasses
or other forage species. If this is the case, consistency in
post-harvest sampling method is important. Results
from this study show that the different post-harvest
sampling methods gave similar rankings for nutritive
value in both years, demonstrating that the different
methods can give consistent results. When a particular
method is chosen, consistency in other factors, such as
time of day of sampling are also important and will
make accurate nutritive estimates be more easily
compared.

Conclusions
When transporting, storing and drying pasture samples
post-harvest, the following is recommended:
• Snap-freeze and transport the samples in liquid
  nitrogen to the laboratory as quickly as possible;
transporting samples in a chilly-bin will result in loss
of nutritive value.
• In the laboratory, store the samples in a standard
  freezer (-18°C) or in a -80°C freezer, preferably not
in a chiller or at room temperature.
• For an accurate estimate of nutritive value, the most
  important factor is to freeze-dry the pasture samples,
oven-drying will result in a loss of nutritive value.

• If there is no access to liquid nitrogen or a freeze-
  drier, then consistency of post-sampling procedure
  is important, as is processing the samples as quickly
  as possible. For example, harvest the samples at
  the same time of day if sampling on different days.
  Avoid the samples being in transit, stored at room
temperature, or in the fridge (chiller) for several days.

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in post-harvest, the following is recommended:

Implementing change: barriers and opportunities

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Abstract
Severe flooding and slips in the Manawatu-Wanganui
region in 2004 resulted in the implementation of the
voluntary Sustainable Land Use Initiative (SLUI), to
support recovery and increase resilience. This paper
identifies the barriers, opportunities and lessons for
the implementation of Whole Farm Plans (WFPs).
The research, conducted in 2016, involved interviews
with 40 farm households. The findings demonstrate
that the values and priorities of both SLUI and non-
SLUI households were similar, highlighting the need
to increase profitability, productivity and environmental
protection. Both adopters and non-adopters express
similar concerns about SLUI, including perceptions
about its bureaucratic nature, cost and complexity.
They differed to an extent when discussing how the
SLUI aligns with their own values and goals. Non-signatories
highlight their resistance to government intervention.
They also feared the SLUI would thwart productivity
and profits. There remains a need to more explicitly
integrate social values and goals in any strategy to
implement Whole Farm Plans.

Keywords: Sustainable Land Use Initiative, barriers,
opportunity, values, environment, resilience

Introduction
The massive storm that hit New Zealand in February
2004 had its greatest impact on the Manawatu-
Wanganui region. The resultant floods constituted the
largest emergency management event in New Zealand
for 20 years, and the first major natural disaster to occur
under new Civil Defence legislation (Ministry of Civil
Defence and Emergency Management, 2004). The total
cost of damage to agriculture alone was estimated at
$180 million, including stock losses; interruptions to
milking; loss of pasture; damage to fences, plant and
equipment; silting; and loss of feed and production.
In hill country, 62 000 individual landslides were
recorded, covering 18 000 ha. Twenty-nine thousand
hectares were severely eroded (Horizons 2004; New
Zealand Press Association 2004).
The major damage in hill country was slips. Erosion
had major, negative impacts on water quality. In
addition, downstream, large quantities of soil were
deposited reducing the protection of infrastructure
and farmland provided by stop-banks. An estimated 200
million tonnes of soil were lost.

The floods re-prioritised erosion control on the local
Council’s agenda. In response, The Sustainable Land
Use Initiative (SLUI) was designed and implemented.
The SLUI aimed to reduce erosion rates closer to
natural levels; build resilience in the rural sector and
in the regional economy; protect lowland communities
from the effects of upstream hill country erosion; and
improve water quality (Horizons 2007).

The SLUI was introduced in 2005. Ten years
later Horizons commissioned research to explore
farmers’ perspectives on how the SLUI contributed to
sustainability and to identify any improvements that
could be made to streamline delivery (Horizons 2016).

Methods
A core data set was developed through a series of
in-depth, semi-structured interviews involving 20
hill country farmers who have signed-up to SLUI, and
20 who have not. In addition, all Field Officers
employed by Horizons completed a questionnaire and
subsequently met as a group with the authors to discuss
their views.

Two priority areas, the Lower Rangitikei and
Tirauame, were identified as the study areas. Horizons
generated a random list of farmers in each area. The
questionnaires were field tested and where necessary
revised. All interviews were conducted, face-to-face
in May-July 2016. The design and data analysis of this
qualitative social research was a triangulated process
where two or more social science methods were used,
in this case interviews and literature associated with
WFPs, to test the strength of views expressed.

Incentives and barriers
Each farmer, after signing-up to SLUI, met the cost of
farm plans and made a contribution towards the cost of
environmental work (11/20). This bracketed ratio, here
and elsewhere in the text, gives the number of responses
over the total possible number of respondents. These
numbers are not statistically valid, given the small

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Implementing change: barriers... (T.A. Nelson, M.A. Brown, S.J. Fielke, A.D. Mackay, P.R. Payne, A.P. Rhodes and W. Smith)

SLUI (Sustainable Land Use Initiative) receives an annual government grant that, after accounting for $5000 spent on-field, is estimated at an average of $200 per farm (2015). The financial benefit of SLUI for participating farmers was a $2958 ha increase in farm land, well beyond the farm gate. They also concluded that erosion rates had lowered to near natural levels, and that the rural sector was more resilient to future major storms, with local communities better protected against upstream erosion, and that water quality had increased. Todd (2015) largely confirmed these findings, which again were broadly confirmed by the evidence presented in this paper, and the views expressed by farmers themselves.

Given the productivity increases achieved and the flow of funds channelled through SLUI, farmers’ uncertainty as to any increase in the sustainability of their local communities might seem paradoxical. Certainly, respondents saw erosion control and flood prevention as increasing environmental sustainability well beyond the farm gate. They also accepted that, as the bulk of funding from SLUI was expended locally, some community members at least have benefited. Studies of the 2004 floods, however, demonstrate that concepts of sustainability go well beyond conventional statistical measures. Farm households described the floods as a generating “coming together”, demonstrated in the mutual aid and support they (the farmers) received. At the same time, the floods highlighted the vulnerability of farming communities as a consequence of loss of public facilities and services, including schools, police and other social services (Smith et al. 2011). Thus, while the inflow of investment associated with SLUI is undoubtedly positive and may have slowed population decline, it is unlikely on its own to address much wider concerns and needs.

The impact and consequences of the storm and floods of 2004 was fundamental to understanding the implementation of SLUI. What stands out in this discussion is the importance of each farmer’s  self-image and values in their policy response. Discussing specific concerns regarding SLUI, those farmers who have not signed-on perceived it as overly bureaucratic, costly (poor value for money), and unduly complex. SLUI farmers express the same concerns. Some farmers associate environmental policies, such as SLUI, with the “bureaucrats” in their Regional Council. However, when questioned in more detail, farmers’ perceptions were more strongly focused on “excessive” paperwork and documentation, and embraced a distrust of all officials, scientists, and other outside “experts”. These interpretations and explanations also tie back to farmers’ deeper attitudes, values and self-image. SLUI and non-SLUI farmers were logical and rational. They shared similar values and farm goals, but differed in the importance of each farmer’s self-image and values in their policy response. Discussing specific concerns regarding SLUI, those farmers who have not signed-on perceived it as overly bureaucratic, costly (poor value for money), and unduly complex. SLUI farmers express the same concerns. Some farmers associate environmental policies, such as SLUI, with the “bureaucrats” in their Regional Council. However, when questioned in more detail, farmers’ perceptions were more strongly focused on “excessive” paperwork and documentation, and embraced a distrust of all officials, scientists, and other outside “experts”. These interpretations and explanations also tie back to farmers’ deeper attitudes, values and self-image. SLUI and non-SLUI farmers were logical and rational. They shared similar values and farm goals, but differed in the importance of each farmer’s self-image and values in their policy response. Discussing specific concerns regarding SLUI, those farmers who have not signed-on perceived it as overly bureaucratic, costly (poor value for money), and unduly complex. SLUI farmers express the same concerns. Some farmers associate environmental policies, such as SLUI, with the “bureaucrats” in their Regional Council. However, when questioned in more detail, farmers’ perceptions were more strongly focused on “excessive” paperwork and documentation, and embraced a distrust of all officials, scientists, and other outside “experts”. These interpretations and explanations also tie back to farmers’ deeper attitudes, values and self-image. SLUI and non-SLUI farmers were logical and rational. They shared similar values and farm goals, but differed in the importance of each farmer’s self-image and values in their policy response.
instance, was the extent to which the policy momentum generated by the events of 2004 has been maintained for over a decade. Seventy-five percent of farmers interviewed who have not yet signed-up still express interest in adopting the SLUI.

Both SLUI and non-SLUI farmers “buy-in” to the threat posed by farm erosion, while also acknowledging other environmental issues including weeds, pests, flooding, and pugging. Farmers are known to respond more positively to environmental policy initiatives based on practical, demonstrable evidence of value and success (Cary et al. 2001). This together with the empirical evidence presented above implies that for some farmers at least, an “information deficit” persists. This was confirmed by non-adopters identifying that they remain open to persuasion, subject to a number of information gaps being filled: more information and understanding, more evidence that SLUI involves a true partnership between Council and landowner (one that respects farmers' goals and reflects an understanding of the farm); confirmation that property rights are observed; less paper work; greater flexibility in implementation of the plan (particularly with respect to the control retained over the management and farm use); and information that would address existing concerns about the financial implications of SLUI on farm business.

International research findings demonstrated that sustainable development involved the interdependence of environmental, economic, social, and institutional factors and the strengthening of these linkages that reduce vulnerability and increase resilience (UNEP 2013). Building resilience is not, as shown, necessarily or directly translatable into annual economic returns, nor easily identified in the potential market value of individual farms. The multi-dimensional nature of resilience is not necessarily explicitly recognised by farmers who, at least in the short-term, view SLUI as an environmental policy directly linked to erosion control and water management, and disconnected to business growth or wider social needs.

The success of SLUI is largely undisputed. There is substantial evidence of the potential to increase its uptake, but the context has changed. Further uptake might be accelerated by a more explicit recognition that SLUI is less of an environmental policy than a broad-based strategy to build sustainability in all its dimensions; recognising that this requires better reframing in terms of trust, respect, and wider business and social goals inherent in farmers' own short-term and long-term management goals.

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