

Joint Scottish Environment  
Protection Agency (SEPA) and  
Scottish Environment Food and  
Agriculture Research Institutes  
(SEFARI) Gateway Crop Production  
Sector Plan workshop outputs  
4th March 2019





The workshop was held on the 4th March 2019 at the Edinburgh Centre for Carbon Innovation. Funding was provided by Scottish Government through the Scottish Environment, Food and Agriculture Research Institutes (SEFARI) Gateway.

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# Executive Summary

The workshop aimed at understanding the views held by various stakeholders about the SEPA Crop Production Sector Plan and how different organisations could contribute to delivery of such a Plan if implemented. Research scientists working in areas related to the key sub-topics were also in attendance to understand the future needs of SEPA and stakeholders.

The day was organised around 6 sub-topics identified in the Sector Plan as key:

- Nutrients
- Water
- Soil
- Biodiversity and pesticides
- Climate Change
- Wider more general areas

The first session explored 4 questions within each of the topics: What are the key issues? What information is currently available? What barriers exist in delivering change? Is there information missing that is needed to move forward.

The top issue facing crop production within Scotland was soil compaction and the need to define soil health, attendees were acutely aware of the role of soil in delivering multiple benefits to the environmental landscape. There was however the perception that there were good existing data related to soil health, however there is currently no clear definition of soil health. Also missing was a monetary value on soil itself however this may be difficult to assess due to the dependence on understanding the value of the services being provided.

To deliver change it was agreed that it is critical to understand the costs associated with any changes. One way in which this might be addressed is through the development of case studies utilising existing knowledge and farmer approaches in managing the landscape, and their associated costs to do this. Such case studies would also help to understand why particular practices are adopted with potential delivery of information

specific to barriers to uptake. Full cost benefit analysis of differing approaches was also seen as being important. Precision agriculture adoption for fertiliser application scored highly in being key for nutrient management. Understanding better approaches to land management was also a key issue in managing water resources but a general barrier to most issues was that of uncertainty.

In general, it was felt that there needed to be better collaborative working with end users and engagement with quality assurance schemes with SEPA complimenting all work. Engaging aggregators of information and agronomists may also offer potential large-scale change through the promotion of changes in line with the aims of the sector plan. It is critical that all advice be truly independent however.

Managing water catchments at a landscape scale using longer term approaches may allow farmers to plan better for the future. Landscape management however should not be driven through regulation but through open communication and joint working towards the desired goal for all. Understanding what incentives may promote change however is also important and links to the development of case studies and adoption practices. Whatever changes are made, it will be critical that they are demonstrable, auditable with a measurable impact for possible incentivisation.

# Session One

## Key Issues

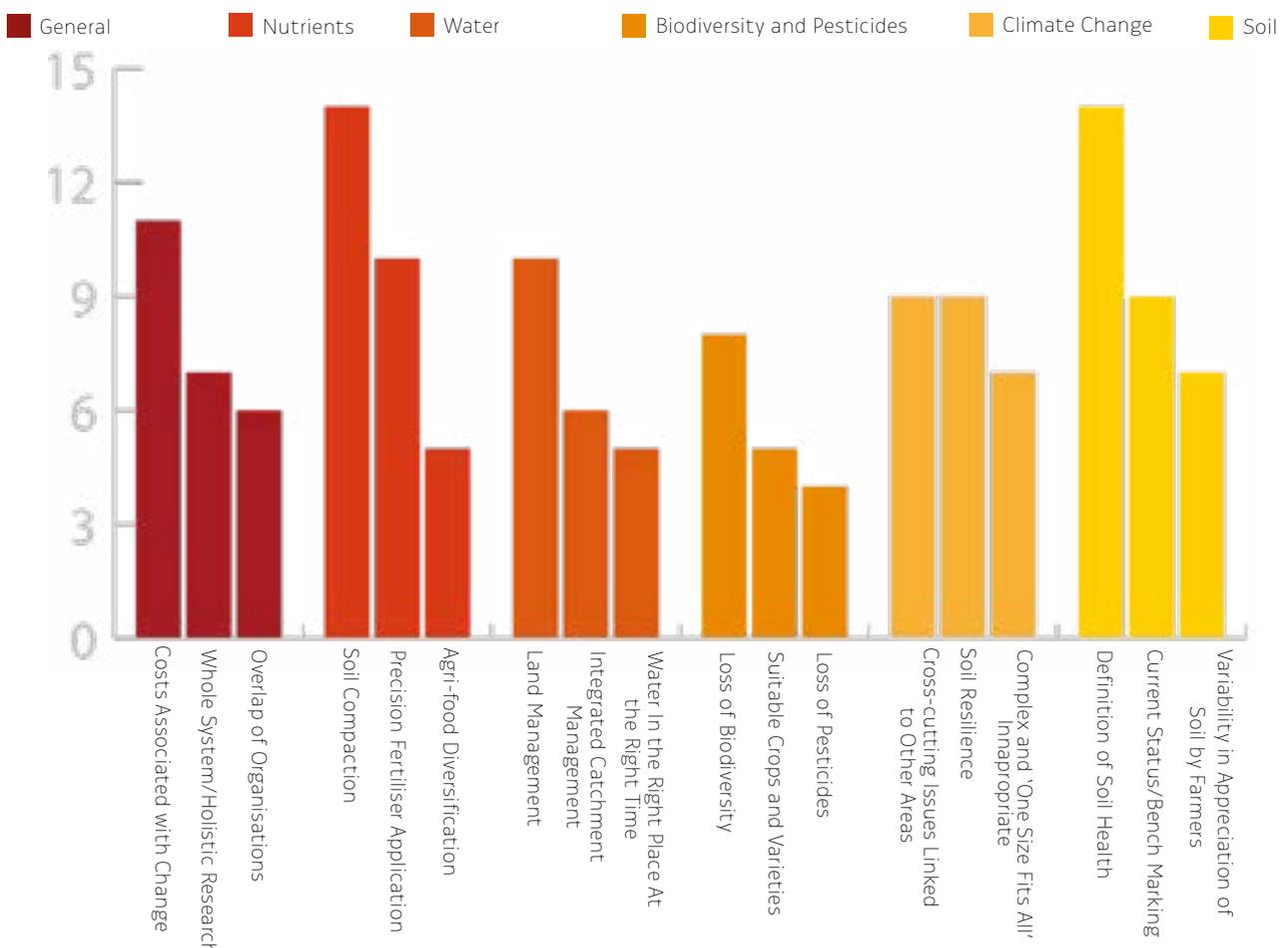
A summary of the voting for each of the key issues within the 6 subtopics can be found in Figure 1. One area which was highlighted as being important was around costs, incentives and, indirectly, the adoption of new technologies. Of similar importance was the need for whole system, holistic research with the landscape being managed in a way that includes all aspects of adaptation rather than just focussing on one specific adaptation. Understandably soil was one area where a wider approach has the potential to benefit multiple services in the wider environment. Despite the need to have more holistic approaches it was also acknowledged that a 'one size fits all' approach was also not the answer due to environmental complexity.

It was interesting to note that in some areas it was felt that we had sufficient baseline data available to be able to do this, e.g. water. Soil is an area

where the current status of soil condition is an issue which relates to defining what a healthy soil is. Soil health is also linked to resilience and was highlighted as an issue in the context of climate change. Biodiversity was another issue where it was widely accepted had decreased. As this group also discussed issues around pesticides there were concerns around the loss of pesticides and more information was required on crops and varieties.

Soil compaction was highlighted as a significant issue with regards to nutrient management and was voted as the top key issue alongside defining soil health. Precision fertiliser application offers the opportunity for improved nutrient management, however for farmers who currently do not use these technologies it is a clear area for communicating their benefits and incentivising farmers in adopting this technology.

Figure 1 - Top 3 Key Issues Highlighted by Attendee Voting for Each Sub Topic



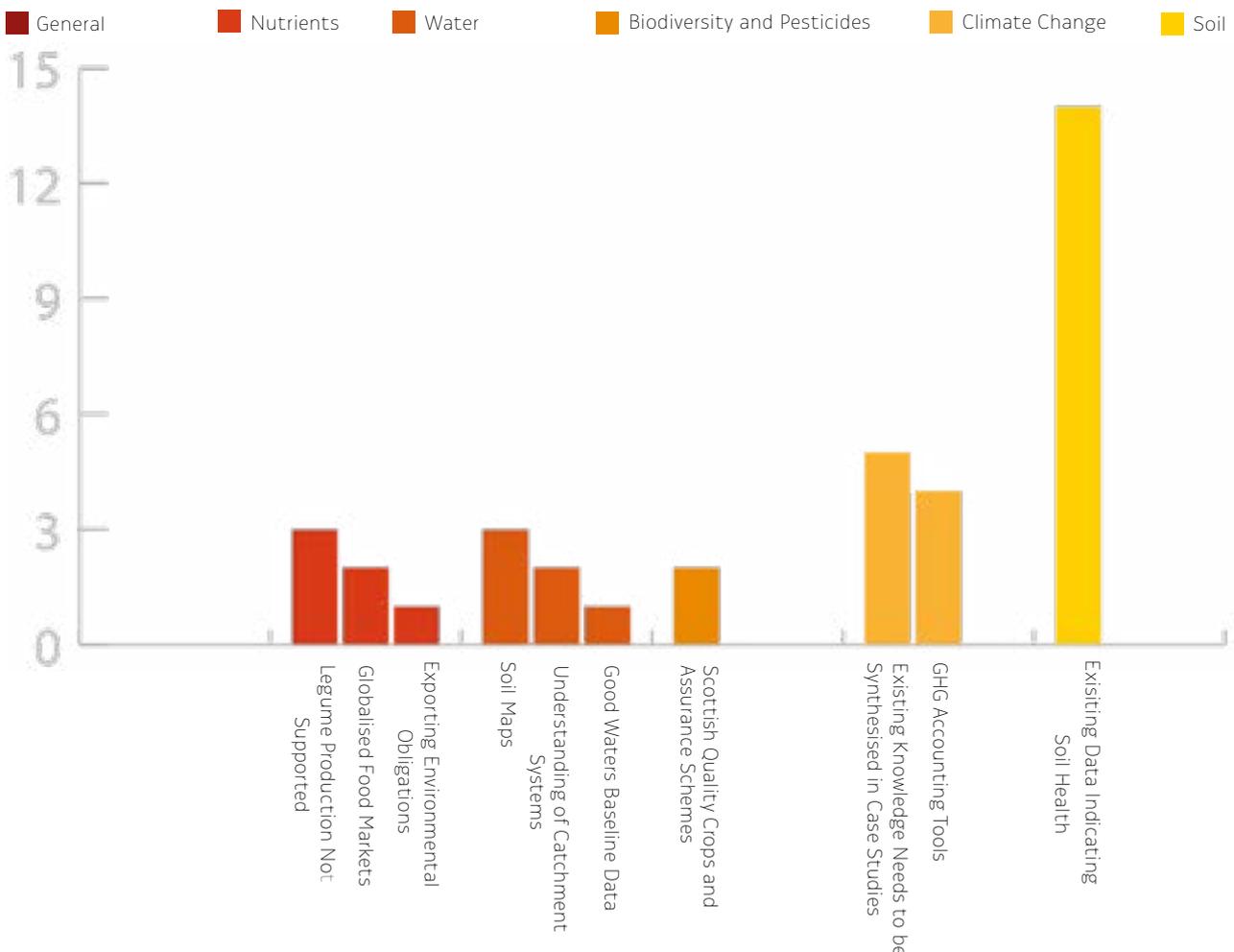
## Available Information

Voting within every subtopic was not applicable as some groups felt that there was insufficient available information currently for their need, applicable voting results and key information can be seen in Figure 2. As mentioned earlier, some existing information is available to help move towards better integration and management of soils at a larger scale with voting clearly highlighting there was the perception of good information available on soil health. Scottish soil maps were highlighted as one such area, with existing availability of maps for associated to risks to surface waters. Other areas also had a lot of information available but clear potential for greater impact exists through highlighting the inherent relationships between subtopics through larger scale case studies. Although the voting suggested there was a lot of soil health data available, soil maps do not provide an indicator of current soil health mapping assumptions and potential temporal and spatial variability in sample collection.

Through the co-ordinated development of varied case studies there is potential to begin to effect change by increasing the understanding of multiple benefits associated with different management approaches. Although good quality information is available there is a need to have targeted monitoring to be able to assess change and add value to changes in practice.

In some areas it was felt that there was information available on management practices with proven benefits that have not been widely adopted. One highlighted area was within the nutrients sub-group. Currently it was felt that legume production was not supported despite evidence that through nitrogen fixation multiple benefits can be achieved. Quality assurance schemes are also well established, but questions were asked as to whether these schemes resulted in measurable changes and improvement.

Figure 2 - Top Available Information By Attendee Voting for Each Sub Topic



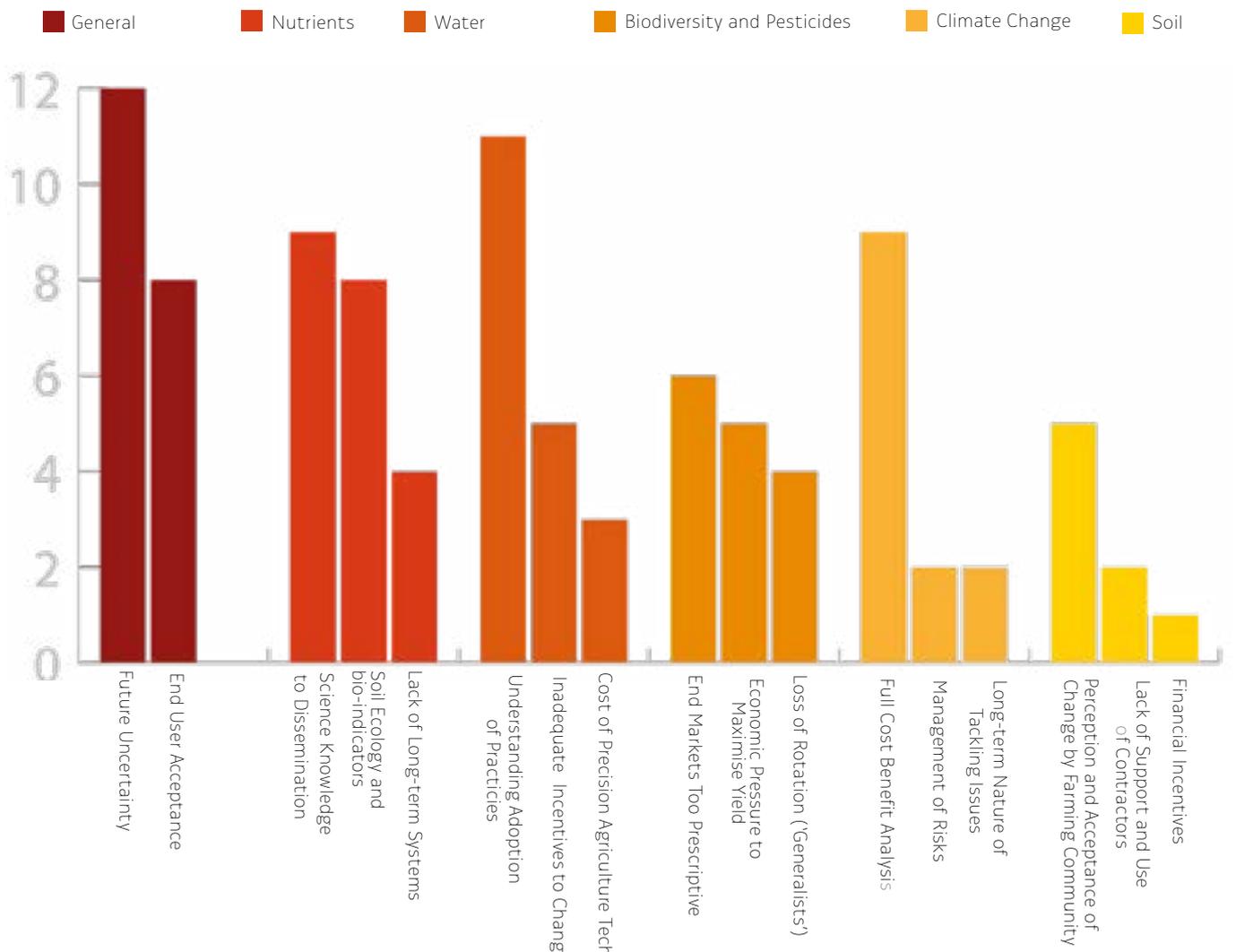
## Barriers

A key barrier raised was future uncertainty, especially with the long-term nature of tackling key issues. End user acceptance, especially on longer term approaches, is critical but it was felt that in some areas could be improved. Ways in which end user acceptance could be improved include enhanced communication between science and end users and the approaches by farmers in adopting new practices. Some technological advancement comes at a cost, precision agriculture for example, however with a lack of support and financial incentives advancement will be limited. Although precision agriculture did not receive a large number of votes there was a lot of discussion around this in relation to other barriers and the potential to improve management approaches.

Driving many of the pressures on farmers is the economic need to maximise yields. Full cost benefits analysis of changes relevant to each. Perception by farmers of change, and then acceptance, was seen as a separate issue and another area where support was needed.

subtopic would help 'sell' the idea of each proposed change whilst highlighting that changes driven by environmental improvement targets are not about reducing profit and yield. Risk management must be addressed in order to promote longer term changes, with incentives driven by the potential impact of adopting new approaches.

Figure 3 - Issues Highlighted as Barriers By Attendee Voting for Each Sub Topic



## Missing Information

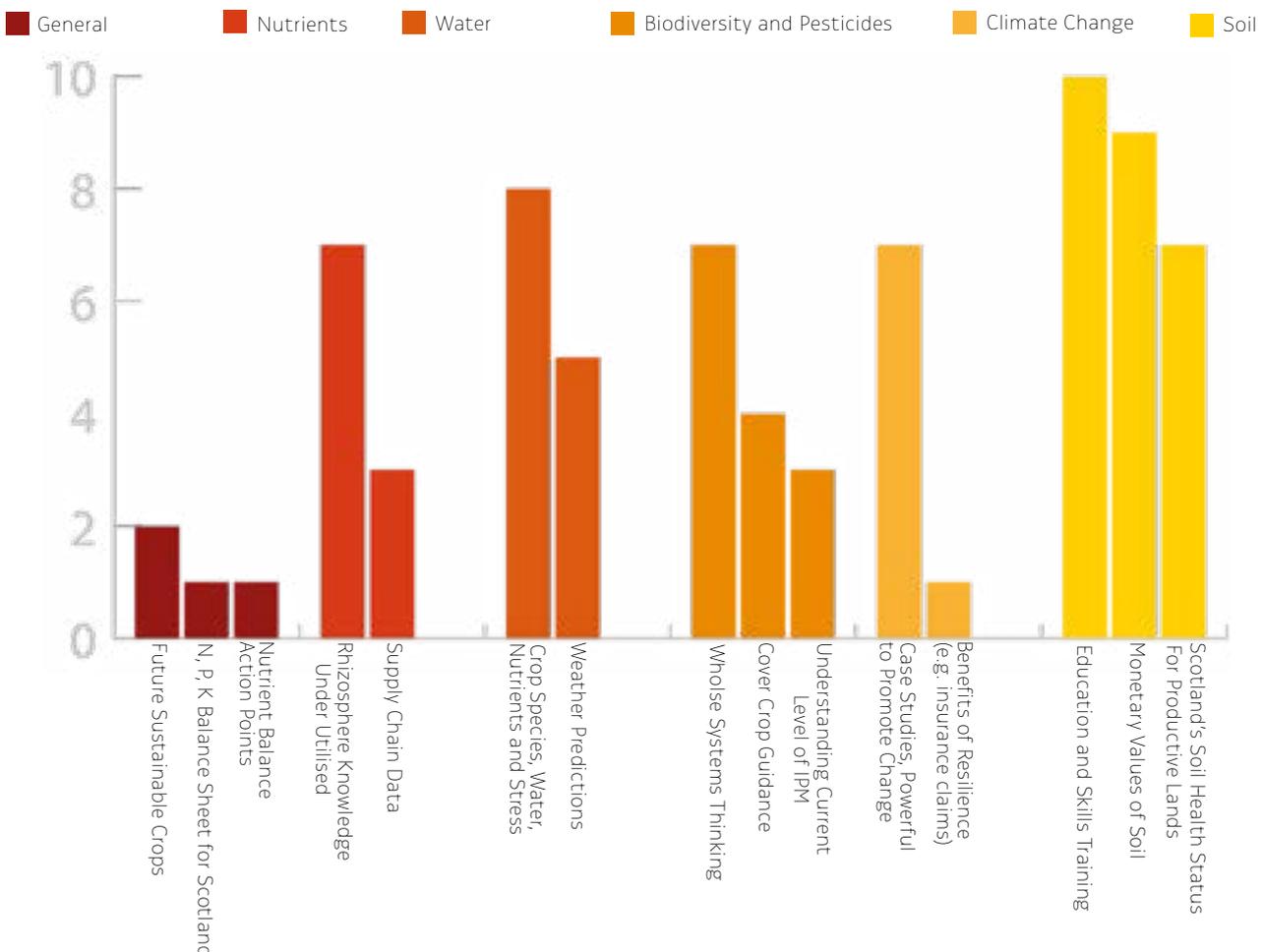
An overarching key issue highlighted by delegates was the need for holistic management of land at a landscape and catchment scale (Figure 4). For water it was felt that there was sufficient information, however the holistic approach should also be applied to biodiversity and pesticide management, where information is limited. Although more information is available for catchment scale water management, combining this approach to include crop species, nutrients and abiotic stress impacts on production would be highly beneficial, however there are currently insufficient data to do this. Better predictions of weather are also important for improved land management (for example timing field operations to avoid trafficking on wet soils and causing compaction issues), better manage water resources at a catchment scale ensuring sufficient water was in the right place at the right time.

Future sustainable crops were another area with limited available information with a further

need for a nutrient (N, P, K) balance sheet for Scotland. Were Scotland to have this 'balance sheet', targeted actions could be taken to improve nutrient management. Information and knowledge on the benefits of managing root interactions with soil directly adjacent to the plant roots (rhizosphere) should also be communicated more widely. Understanding soil ecology was an issue raised under the 'barriers' heading, however it would perhaps be more relevant relating to missing information.

Suggestions for removing this barrier included the development of a biological indicator matrix. Such a biological indicator matrix maybe relevant to more than the nutritional sub topic and offers potential opportunity for assessment of properties of soil in relation to environmental quality, and advancement of the principle of soil biology as biological indicators.

Figure 4 - Missing Information By Attendee Voting for Each Sub Topic



Areas of missing information were predominantly linked to needs for better longer-term management of each sub topic and in understanding the current position. Better guidance for selection, establishment and benefits of cover crops and integrated pest management (IPM) were identified.

Highlighted at the meeting was that there is a wealth of information and experiences that can be used to help engage and promote change. Case studies were viewed as currently missing and could be a powerful tool for highlighting the multiple benefits associated with changing practices under the goals of the sector plan. As part of this there is a need to value soils and increase education and skills training for farmers and practitioners working with soil.

## Session Two: Key Actions and Ways forward

The second session of the day looked more closely at key actions and the future with some sub topics highlighting priorities. The following provides an overview of these discussions for each sub topic.

### General

Key opportunities and research gaps discussed in greater detail focussed on water management and raised the question of whether licensing was appropriate. As part of the licensing question the issue of water availability and forecasting at catchment scale to better manage water was discussed. Although the workshop was focussed on crop production aspects of water management, and the role of land management, it was noted that it was important to understand the overall use of water from other industries in the catchment, not just agriculture.

The action identified as key to moving forward was better working with end users. This could be achieved through engagement with quality

assurance schemes where SEPA, by reputation, could compliment such work.

Some of the issues discussed in the morning session linked to supply chains. Future engagement should look to address these supply change constraints on future adoption of adaptation strategies by land owners and farmers.

### Nutrients

Monitoring, which also covers function, provides an opportunity to develop a standard quality suite. The use of standards may also be used for tighter management of bulky organic applications and incorporated into quality assurance schemes. Specific opportunities around nutrients include the better understanding of micro nutrients and the use of 'natural' nutrient cycling, such as nitrogen fixation by legumes and the use of compost. A key opportunity in all of this is working more closely with aggregators of information and agronomists to communicate the best information to have the greatest influence and promote change in line with the aims of the sector plan.

Discussed in the morning session was the opportunity to improve the use and uptake of digital technology and connectivity; this was a key action for the future in this sub-topic. Cover cropping was also discussed where it was mentioned that as yet it is currently unregulated and could be included in quality assurance schemes, something discussed in the 'general' sub topic as a key action for SEPA. Supply chain innovation should also be addressed and investigated further for Scotland. Finally, a critical priority moving forward is truly independent advice on the issues discussed.

### Water

Integrating all aspects of landscape and catchment management will allow greater, sustainable, use of groundwater and surface water resources. Taking up this opportunity offers the ability to better understand the multiple uses of water within each catchment and, understanding better the management needs based on usage, will increase water resource resilience.

Integration of soils management, such as the use of low ground pressure tyres, into catchment water management not only highlights the role of soil for multiple benefits but also the benefits of a more holistic approach. Highlighting water resource demands to consumers (the public) would also create further opportunities to reduce pressure on water use through acceptance of perfectly consumable produce with potentially less visual appeal, e.g. "wonky" potatoes.

Actions in the short to medium term include better understanding of emerging pollutants and quantifying groundwater resources and recharge. Improving irrigation efficiency and the adoption of new, different, technologies dependent on crop would also help reduce water resource pressure. Evidence and approaches to irrigation in more extreme environments in other countries would also help improve perceived efficiencies in irrigation.

Current priorities should include establishing soil monitoring and better use of current soil quality assessment tools, such as visual soil assessment. The additional role that precision agriculture could play should not be overlooked and quantifying the full economic reality, both on the farm and the wider environment, would help validate the approach. Longer term priorities might include the use of remote sensing, nano sensors and plant sensing to increase the spatial resolution of soil health status.

## Biodiversity and pesticides

Moving forward from the current position requires moving away from the field or farm scale to a landscape-based management scheme. All farms within the landscape, or catchment, have the potential to contribute and benefit from changes. These contributions to change may be linked to financial incentives. It was noted that part of the current problem is that any change may occur within existing schemes at different points on different farms due to typical 7-year rotations. Using a longer-term approach would allow better planning for farmers. Such an approach would require collective management but progressive farmers, 'champions', within each region may be able to effect change through demonstration of

their experiences and practices. Fundamentally however it will be crucial to define better the term "biodiversity" for incorporation into any new scheme. As mentioned in other sub-topics there would be multiple benefits to any scheme should all key sub-topics be included in a single scheme rather than a disparate series of schemes dependent on the different sectors.

With any approach taken for a new scheme the role of SEPA was discussed with unanimous thoughts that it was key not to regulate such an approach but more to facilitate change through local offices. Communication of such a change, and the processes, would be key and likely to necessitate inclusion of multiple stakeholders including academics, government, non-governmental organisations and farmers. Guidance and advice to Scottish government would be necessary on specific targets and issues to be addressed to help and inform environmental policy. Once targets and priorities were set further work should include highlighting knowledge gaps and potential incentives to farmers to deliver to the new scheme.

## Climate change

Outputs from this group was more focussed on the sector plan itself addressing some of the consultation plan questions listed below:

- Have we got it right?
- How can we move forward in specific areas and partnerships?
- Are there clear actions?
- Should there be something else?

One issue was that the sector plan put 'energy and climate' together whereas climate change has broader drivers, impacts and implications with a need to address mitigation and adaptation. In other topics there were discussions around a 'flexible' approach with the awareness that one rule doesn't fit all. Regarding climate change, there was a suggestion of the use of 'flexible adaption pathways' to allow the management of risks and allowing adaption as new evidence develops. Links to international approaches should also be

utilised in order to gather best practice approaches being adopted elsewhere and assess technologies which may be applicable to Scotland. Like other discussions, it will be important to measure appropriately in the wider landscape key properties that govern ecosystem processes and integrate models which can predict outcomes at multiple scales.

Precision farming was an approach mentioned in more than one sub topic during the day. A precision farming approach has the potential to reduce impact within multiple sub topics, for example through improving soil quality through controlled trafficking, and, reducing greenhouse gas emissions via improved nutrient management. Using these 2 example topics of soil quality and fertiliser application there is an opportunity to incorporate information into a case study as a good example of using such technologies for multiple benefits. Involving trade bodies (from fertiliser and seed suppliers) was also seen as key in climate change mitigation, adaptation and resilience. Effective communication of climate change risks is required to generate support and momentum to change allowing adaptation and planning for future increasing resilience of the sector.

## Soil

The aim of the afternoon was also to ensure that there was an opportunity to bring all ideas forward relevant to the crop production sector plan. Some areas relating to soil were missed including those around soil regulation, threats from erosion (including tillage and wind erosion) and compaction, temporal variations in soil health and current understanding of the use of indicator species to assess soil health.

Many of these ideas can be addressed to varying extents with the knowledge currently available to raise awareness and begin to change practices. For example, precision farming, and the incorporation of soil maps, may help in highlighting soil compaction risk with the development of remote sensing offering future opportunity for improvement. Effective communication with key influencers, in relation to agronomists and information aggregators, can help in introducing

ideas and opportunities to wider networks. Also mentioned was the role of SEPA in helping change and a move away from a regulatory approach to more of a facilitator role with an expectation that take up by farmers would be voluntary. With any change however it will be key to be demonstrable, auditable with a measurable impact for potential incentivisation. The scale of management approaches has been mentioned numerous times with a move away from field scale to more of a catchment or landscape approach. The potential for unintended consequences should be fully assessed with any change viewed in a global context.



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