Restoring slate quarries of Snowdonia: Principles, Policies and Plants

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Presentation at ‘Planning the Reclamation of Hard Rock and Limestone Quarries’, Sheffield, April 2007.

EU LIFE -Environment funded project

TWIRLS – Treating Waste for Restoring Land Sustainability

www.bangor.ac.uk/ies/TWIRLS/TWIRLS_home.htm

Alfred McAlpine
Slate

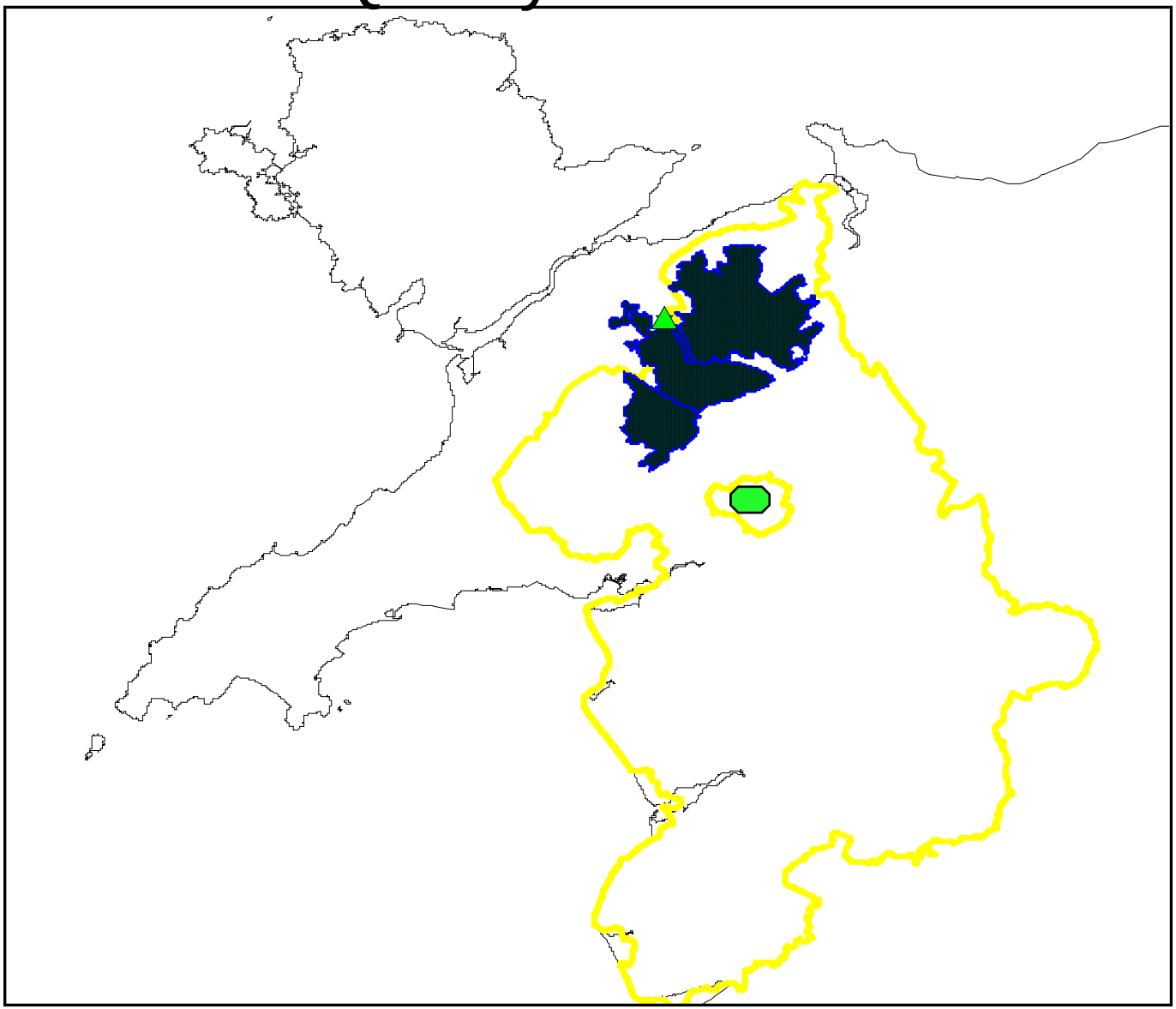
UPM Kymmene
(UK)

Welsh Assembly
Government

Soil Science Institute of
Athens

Titan Cement S.A., Envar and United Utilities are also gratefully acknowledged.

Quarry Locations



North Wales

pSAC Eryri
(20,000 ha)

Snowdonia
National Park

Penrhyn
Slate Quarry

Blaenau
Slate Quarry

Environmentally Sensitive Area

Both quarries lie at the edge of Snowdonia National Park and the Eryri SSSI.

Annual Rainfall 2.3 m

Elevation 150 - 400 m a.s.l

Annual air temp 9.3 ^{o}C

Culturally Sensitive Area

Penrhyn Quarry is located in the small village of Bethesda, once a thriving quarry community

Economically Sensitive Area

This quarry is located in the town of Blaenau Ffestiniog, one of the most socially deprived areas in the EU.

Why Intervene?

- Slate is slow to weather
- Slate waste is blocky with no ‘fines’
- Free-draining
- Low in nutrients
- No organic matter
- Natural regeneration takes >100 years

Ecological Principles for Restoration

- Identify appropriate end-use, habitat type, plant species;
- Kick-start primary succession, not overtake it;
- Create islands of vegetation;
- Connectivity to existing habitats;
- Plan for an ecosystem that is self-sustaining;
- Manage potentially invasive species;
- Take a whole-ecosystem approach;
- Make the most of on-site resources for soil-forming materials;
- Leave some bare areas for lower plants.

Planning Considerations for Restoration

- Section 106 Agreement Town & Country Planning;
- New quarrying plans must include a restoration plan for the whole quarry;
- Environmental bond;
- Restrictions on importation of topsoil;
- Minerals & Planning Officer agreement on importation of soil-forming materials and plant species;
- MPO agreement on final land-form;
- Encourage community buy-in of restoration scheme through ‘information days’ and survey of opinions.

Land - forming

Whilst quarry benches attract rare birds like choughs, more naturalistic landforms providing a mosaic of gradients, scree and rock faces are now preferred. ‘Landscape blasting’ techniques.

Land - forming

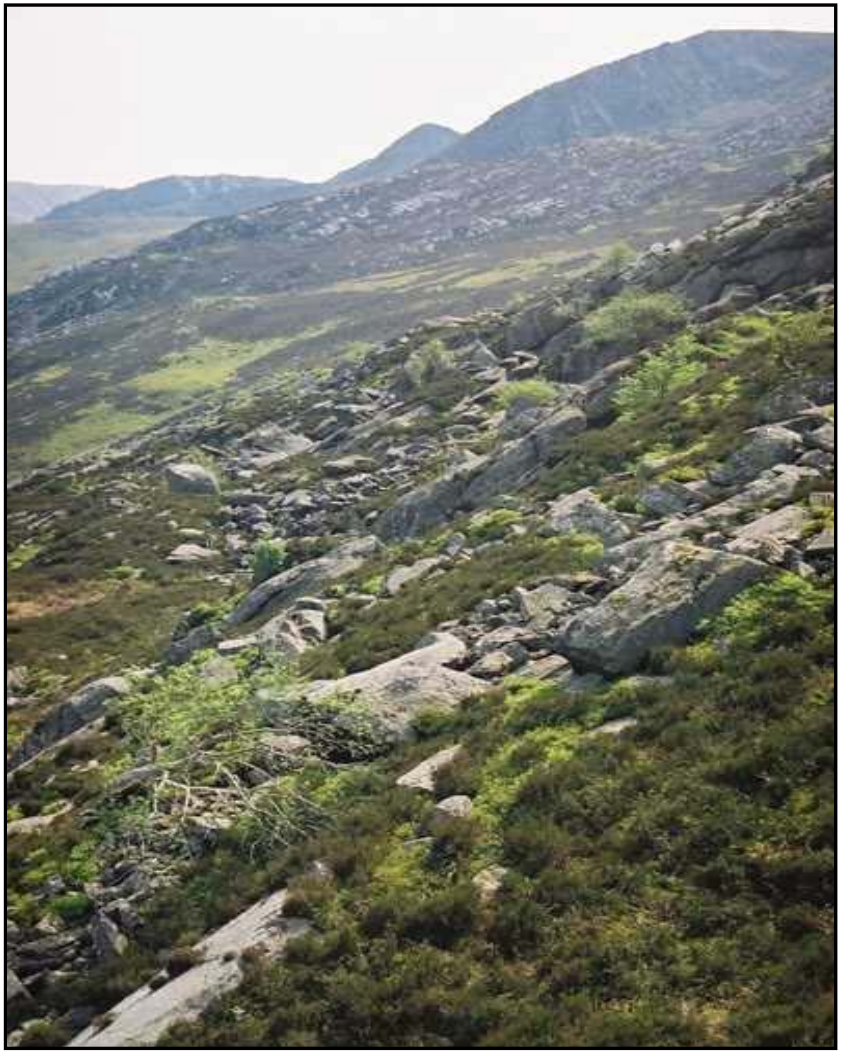
Before

After - 0.5M m^3 slate moved

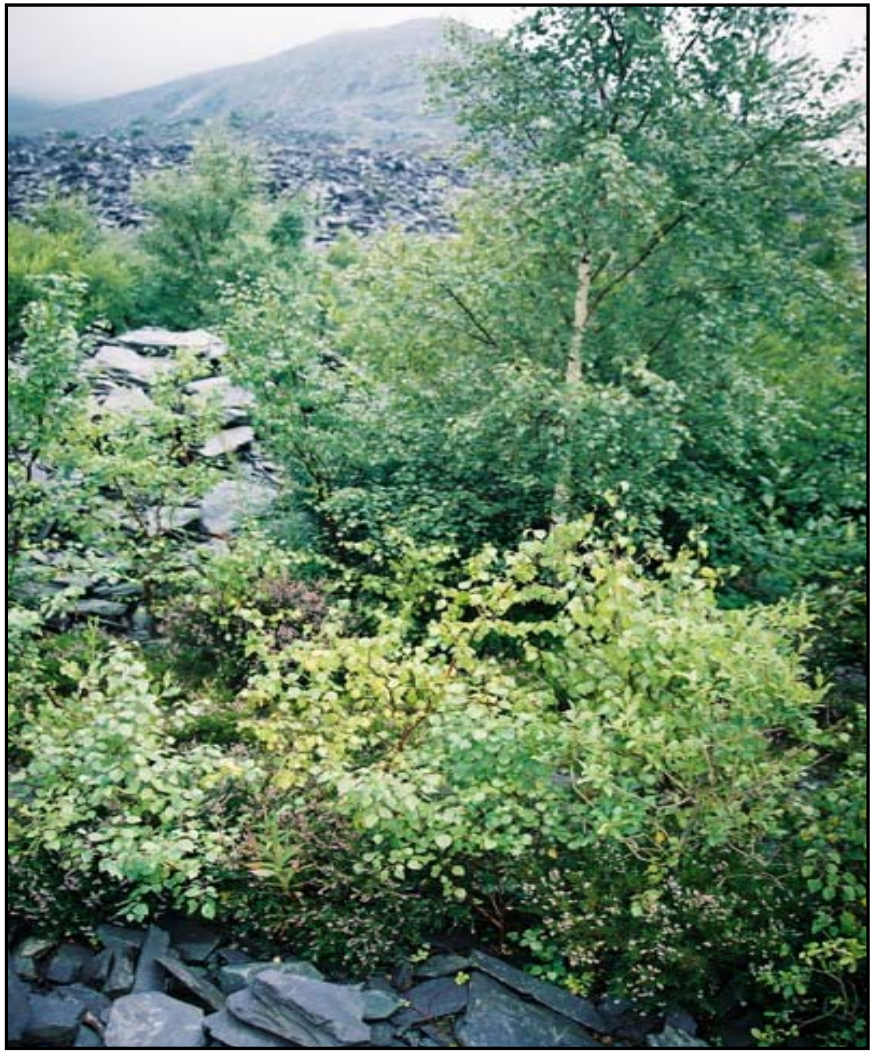
Planning required removal of flat tops and terraces (unnatural) replaced with S-shaped sloping profiles, variable gradients, feature rocks, scree. Landscape diversity increases biodiversity.

Restoration Targets

Upland Scree Assemblages



Lowland Broadleaf Woods



Heathland Restoration

We tested three approaches:

- Direct transfer of heathland turf;
- Plant heather seedlings;
- Direct seeding with harvested heather ‘brash’;
- Direct seeding with seed capsules and a grass nurse onto compost.

Heathland Restoration: Direct Transfer of Turf

Only sheep excluded

Sheep and rabbits excluded

After 5 years

Heathland Restoration: Direct Seeding

Physical protection important for young seedlings of *Calluna vulgaris* and *Erica cinerea*

Heathland Restoration: Using Compost

Composts are neutral pH and high in available N and P;

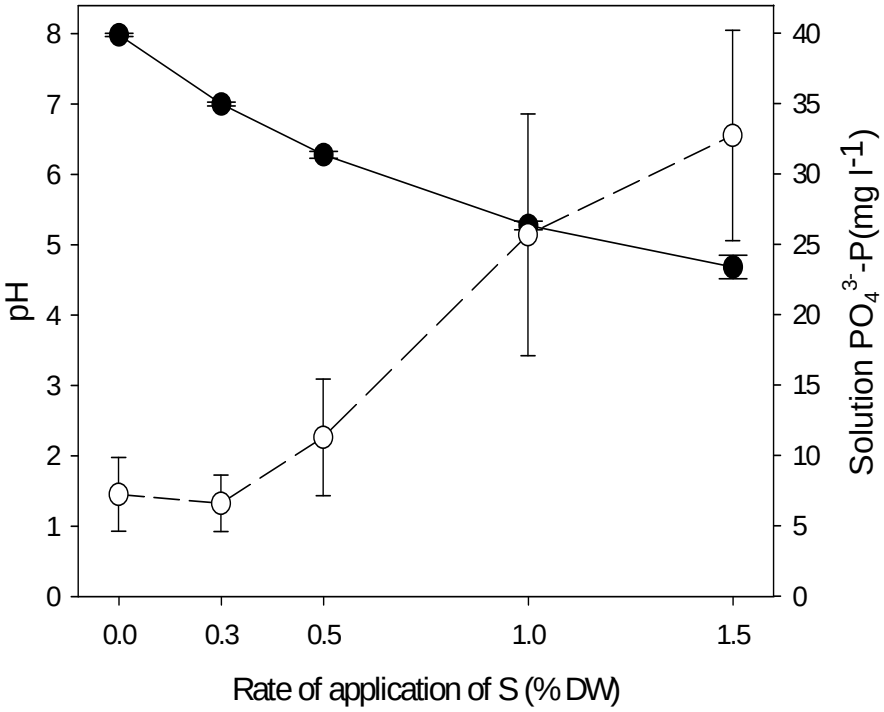
Disadvantageous to slow-growing heathland species;

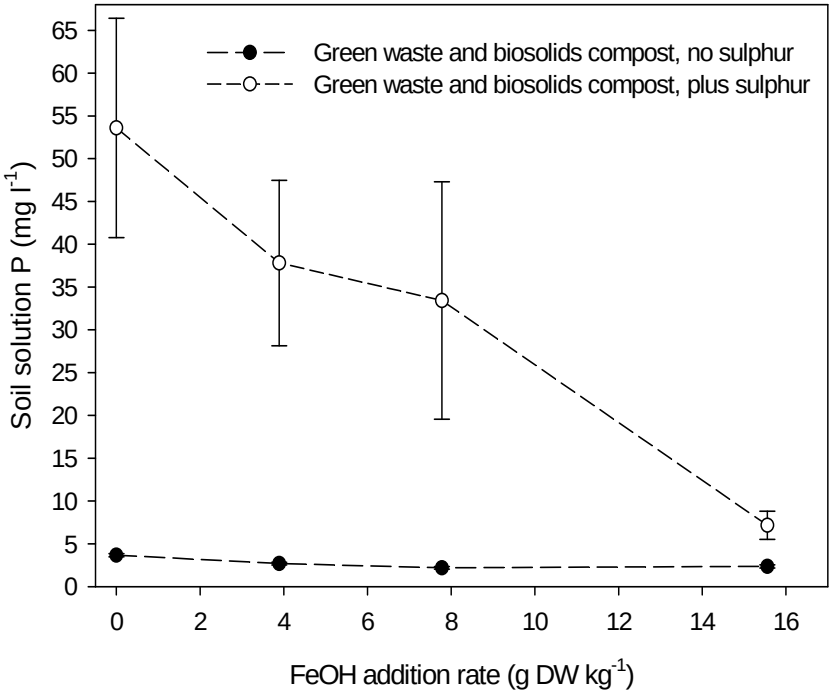
Industrial by-products mixed with compost can modify chemical properties to suit acid heathland establishment on slate waste;

Sulphur wastes and water treatment sludges containing iron hydroxide are by-products from petrochemical and water treatment industries, respectively.

Heathland Restoration: Using Compost

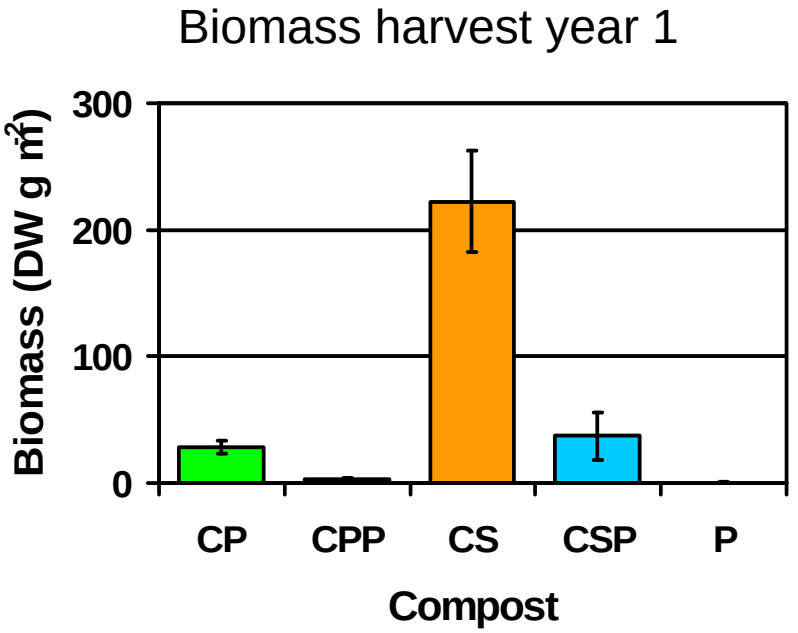
Addition of waste elemental sulphur (S^0) to composted green-waste is an efficient method of reducing the pH (left) to that of heathland soil whilst $Fe(OH)_3$-sludge wastes bind phosphate solubilised by acidification (right).





Heathland Restoration: Using Compost

Experimental layout of plots and plant growth in year 1.



Compost plus slate sand was ‘best’.

CS compost of biosolids, greenwaste + Slate fines

CP compost of biosolids, greenwaste + Papermill fibre

Summary

Considerations

- planning constraints
- environmental, social and economic needs

Target end-use

- often biodiversity conservation for quarries

Ecological framework

- substrates
- plant species
- sympathetic landscapes
- connectivity to existing habitats and landscapes
- whole-ecosystem approach
- minimum intervention
- some bare areas.

Restoring Habitats of High Conservation Value after Quarrying Best Practice Manual

www.bangor.ac.uk/ies/life/life.htm