Assessment and Mitigation of Forest Harvesting Soil and Nutrient Losses from the Acid-Sensitive Burrishoole Catchments

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COFORD
NATIONAL COUNCIL FOR FOREST RESEARCH & DEVELOPMENT

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National University of Ireland, Galway

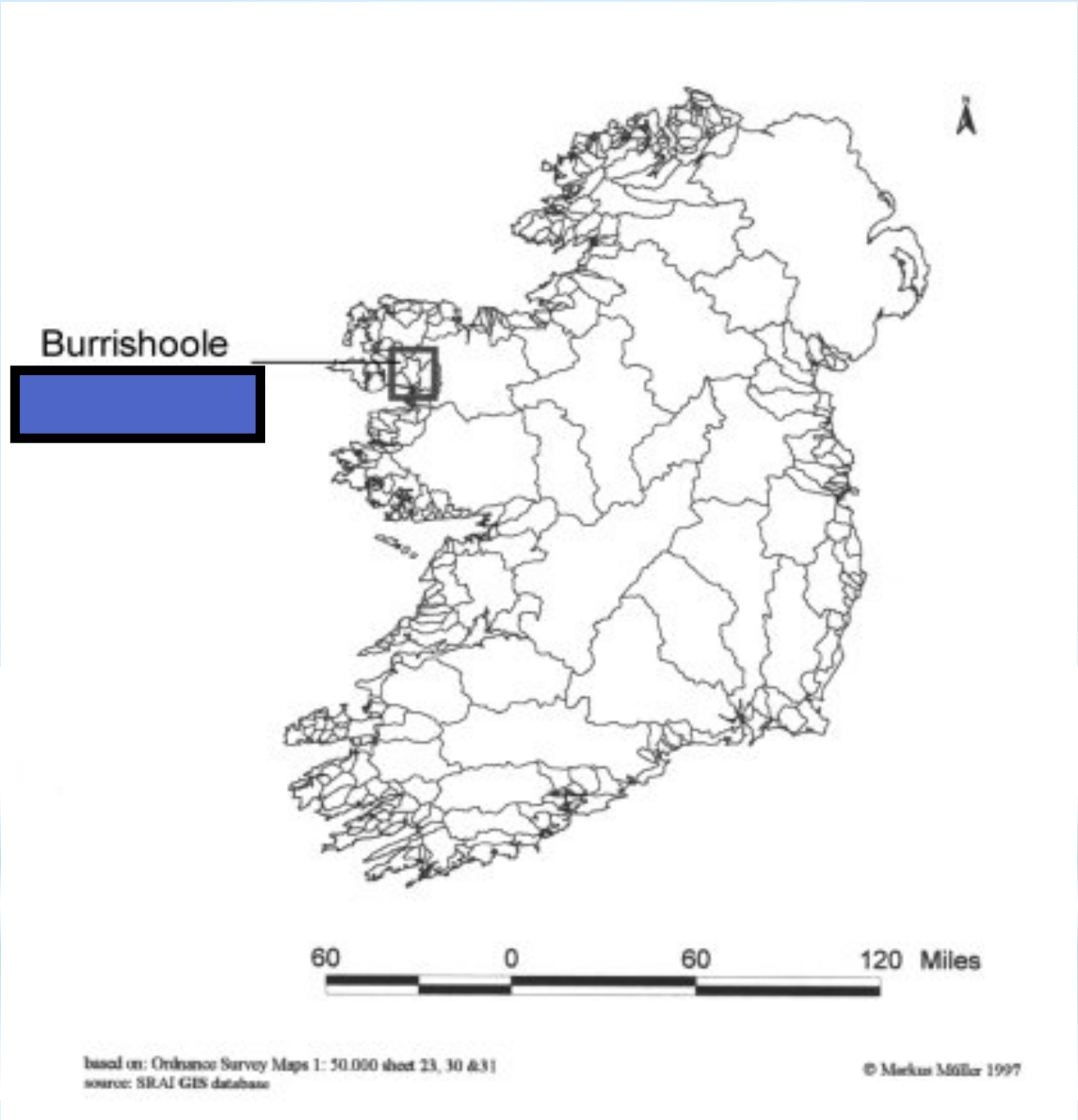
* Four Burrishoole Catchment Projects

* The **SILTATION** Project (2004-2006) (Srahrevagh) focused on the impact of harvesting – using best management practice - on **flows** and **suspended sediments** in receiving waters.(MR, LX, Markus Mueller)

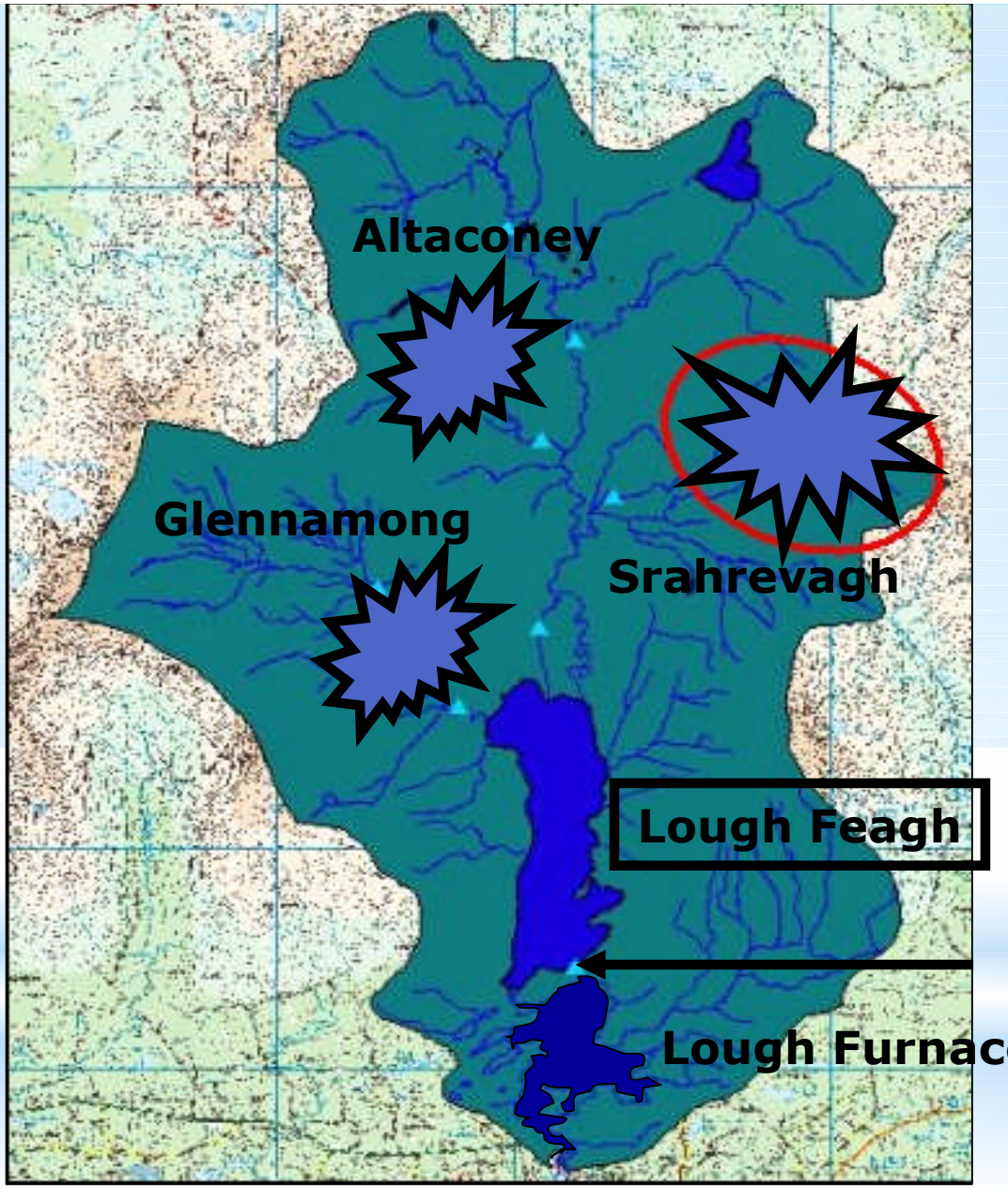
* The **SILTATION and PHOSPHORUS** Project (2005-2008) (Srahrevagh) examined **phosphorus and sediment** changes in the receiving waters after harvesting.(MR, LX, Mark O'Connor)

* The **SANIFAC** Project (2008-2012) (Srahrevagh, Glennamong) examines **mechanisms of nutrient releases** after clearfelling, and **mitigation measures**, including the seeding clearfelled areas with **native grasses.(MR, LX, MOC, Connie O Driscoll, Zaki-ul-Zaman)**

* The **HYDROFOR** Project (2008-2013)(Altaconey, Glennamong) evaluates the effects of clearfelling a **riparian buffer zone**, 3-4 years ahead of harvesting the main forest.(MR, Mark Healy, John Regan, Joanne Finnegan)



Location of Burrishoole catchment



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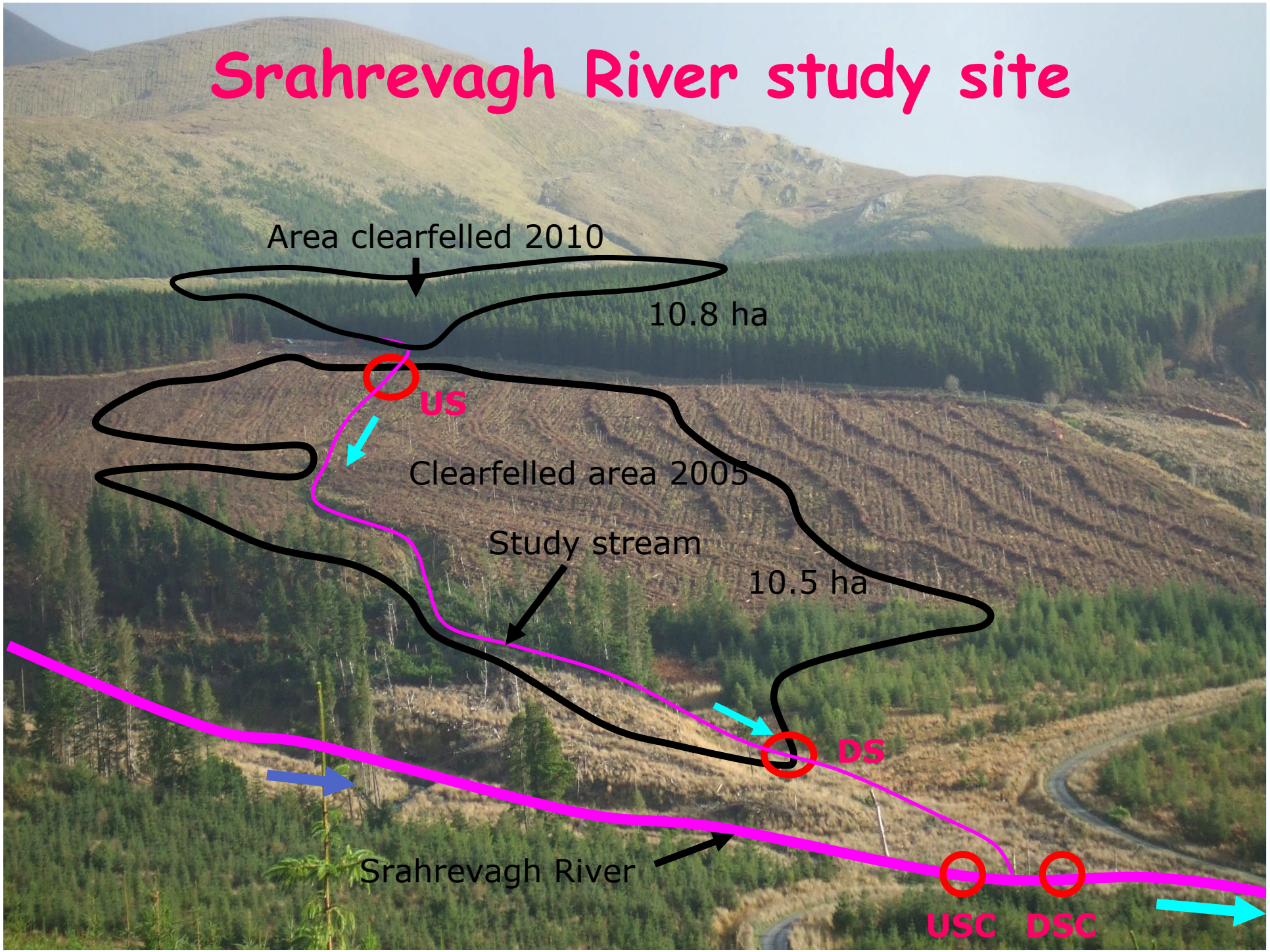
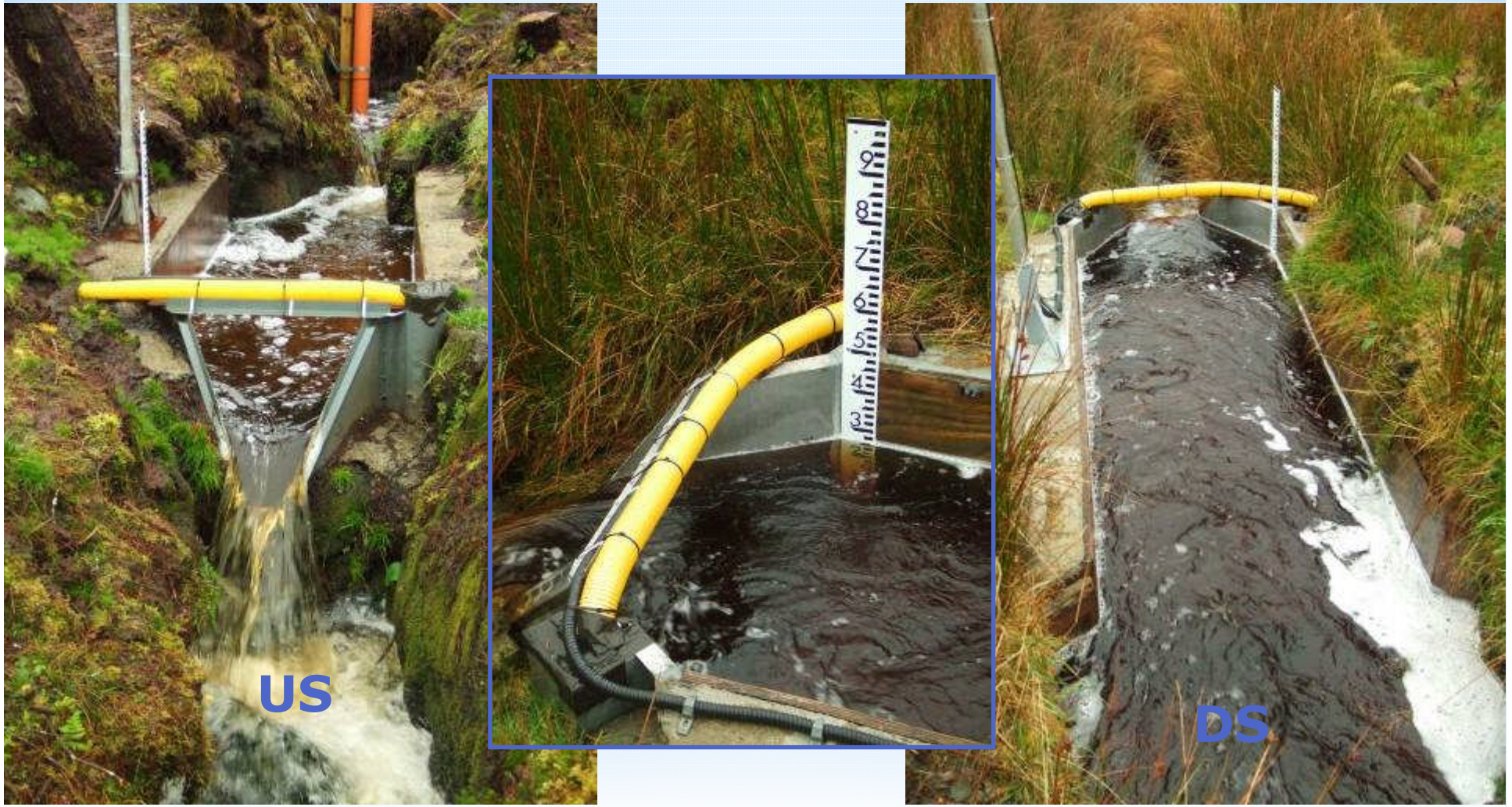
Location of study catchments within Burrishoole catchment


Srahrevagh River study site
Area clearfelled 2010
10.8 ha
US
Clearfelled area 2005
Study stream
10.5 ha
DS
Srahrevagh River
USC
DSC

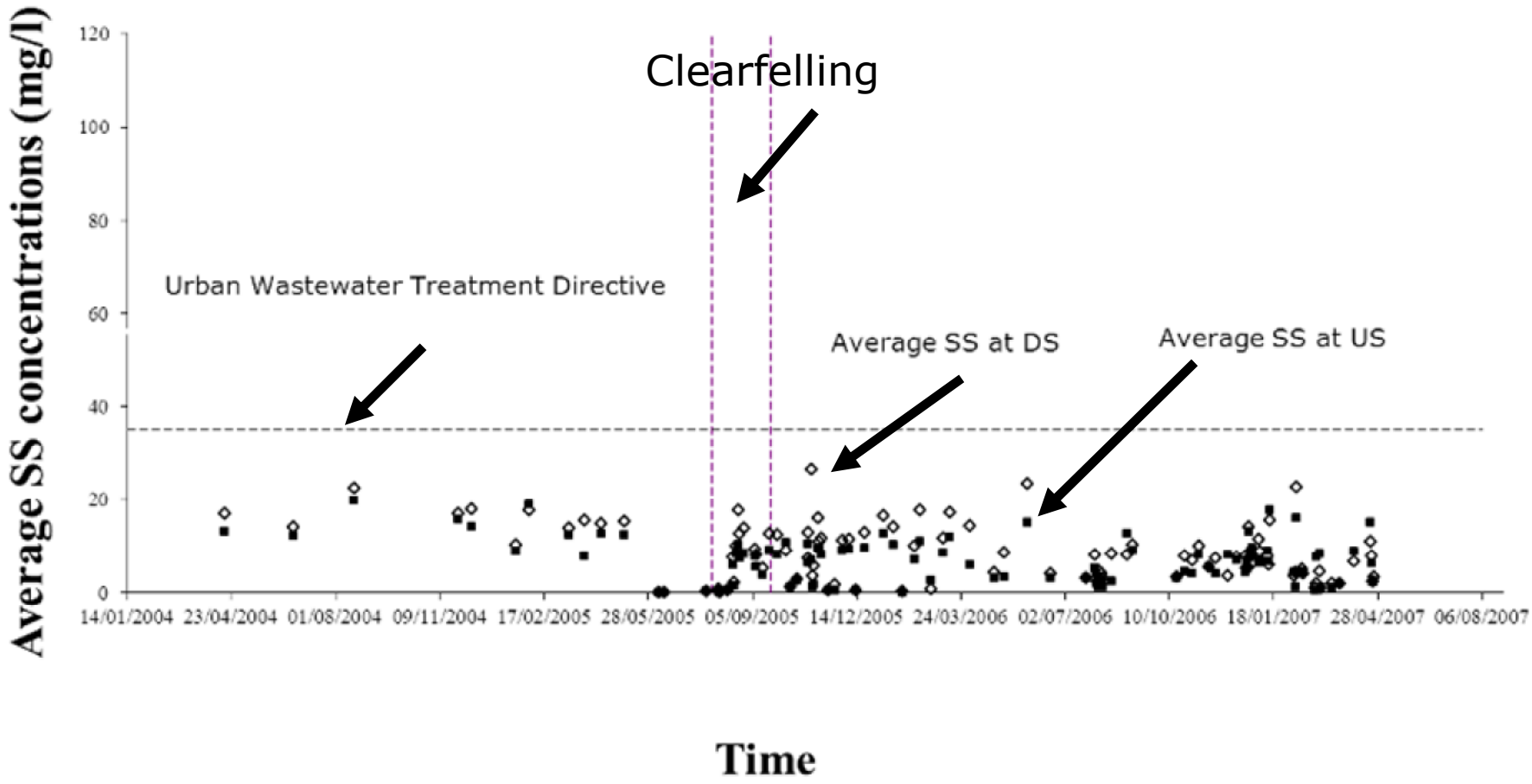
Flumes

National University of Ireland, Galway
Ollscoil na hÉireann, Gaillimh

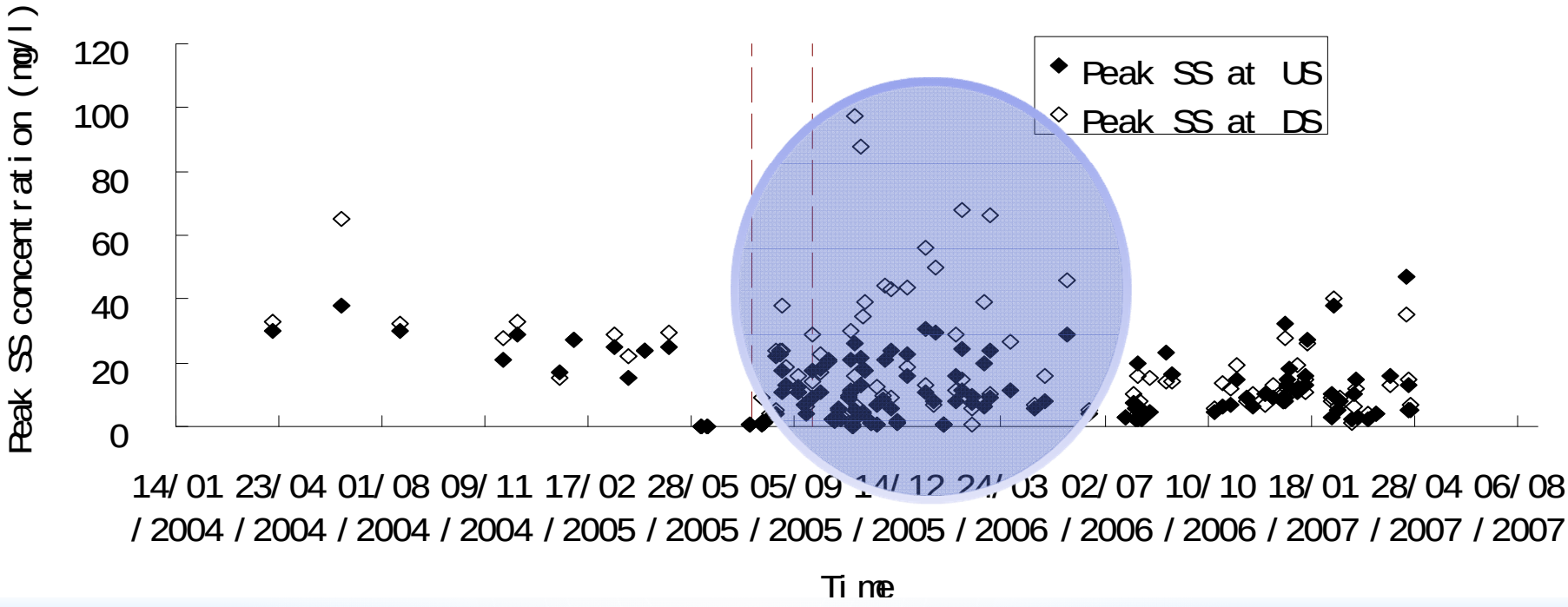


Funded by EPA, COFORD, Coillte Teo., NPWS
Readings every five minutes since April 2005

Average suspended sediment (SS) results for Srahrevagh River

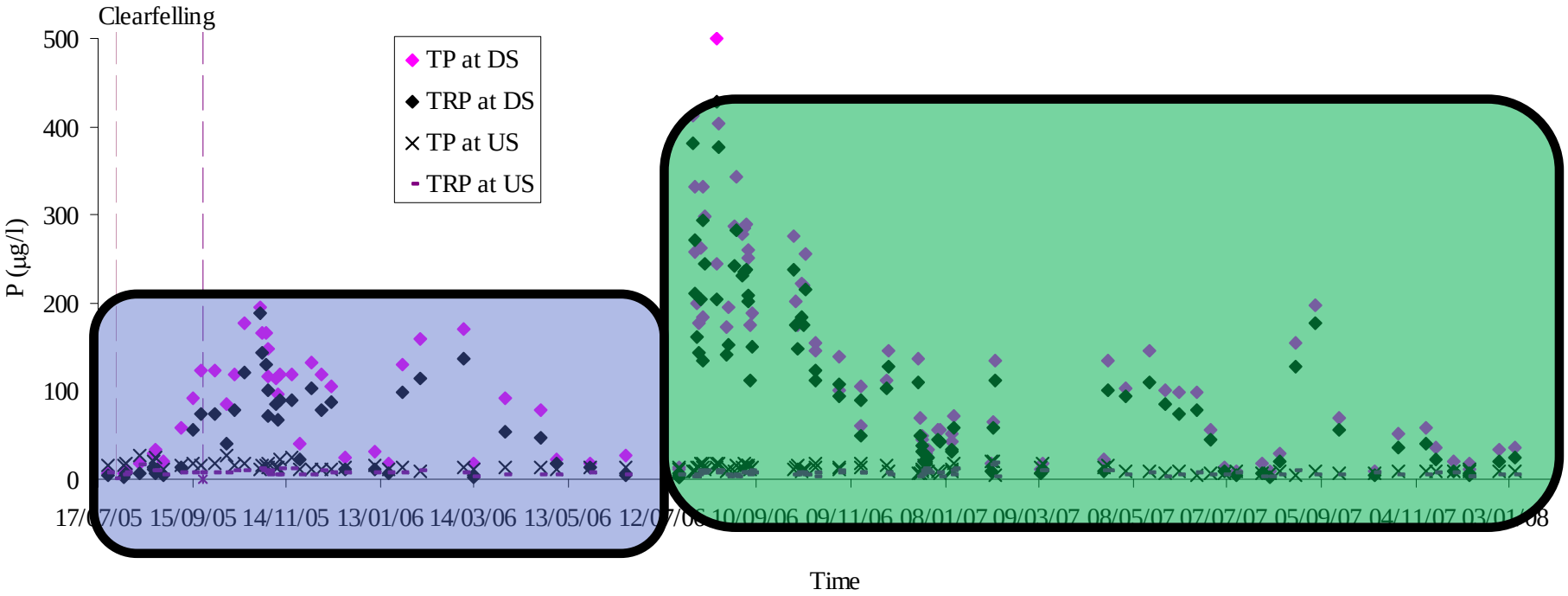


Peak suspended sediment (SS) results for Srahrevagh River



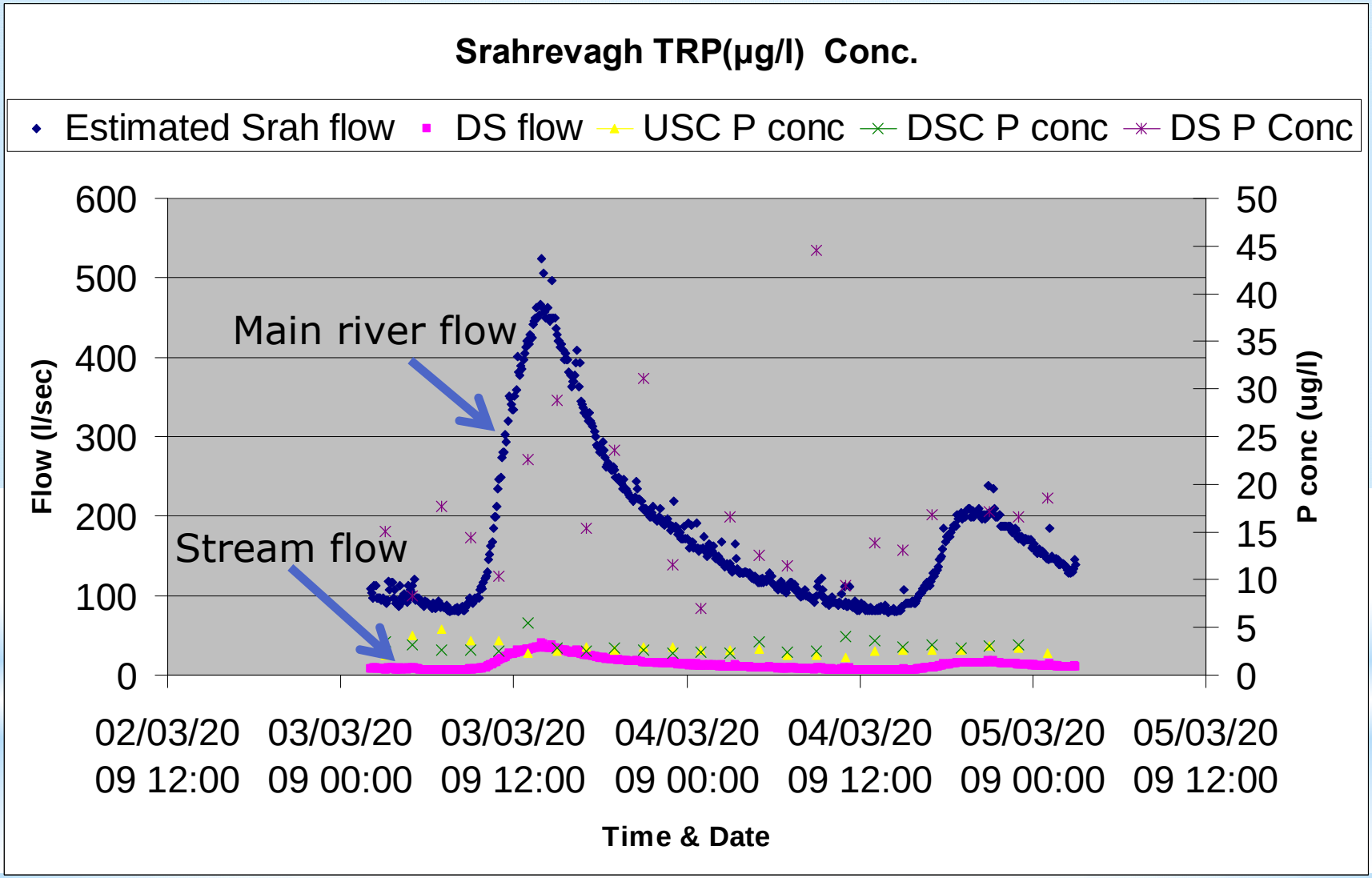
The impact of clearfelling on the SS only lasted for about 6 months.

*Phosphorus results



On August 1st 2006, concentrations up to 500 µg TRP/l were measured in the samples leaving the study coune; these were the highest concentrations recorded during the study.

TRP and TP are low and constant in US, giving the average concentrations of 6 µg/l and 14 µg/l, respectively.


Srahrevagh TRP(µg/l) Conc.
Estimated Srah flow
DS flow
USC P conc
DSC P conc
DS P Conc
Main river flow
Stream flow
Flow (l/sec)
P conc (ug/l)
600
500
400
300
200
100
0
50
45
40
35
30
25
20
15
10
5
0
02/03/20 09 12:00
03/03/20 09 00:00
03/03/20 09 12:00
04/03/20 09 00:00
04/03/20 09 12:00
05/03/20 09 00:00
05/03/20 09 12:00
Time & Date

Long term impact of forest harvesting on water quality

- Harvesting didn't significantly increase the average SS concentrations in the receiving water when best management practices were strictly followed.

- The forest clearfelling and harvesting in the Srahrevagh Study area had very limited impact on flood risk downstream.

- Total reactive phosphorus (TRP) increased to about 200 μg/l in Nov. 2005, 1 month after clearfelling.

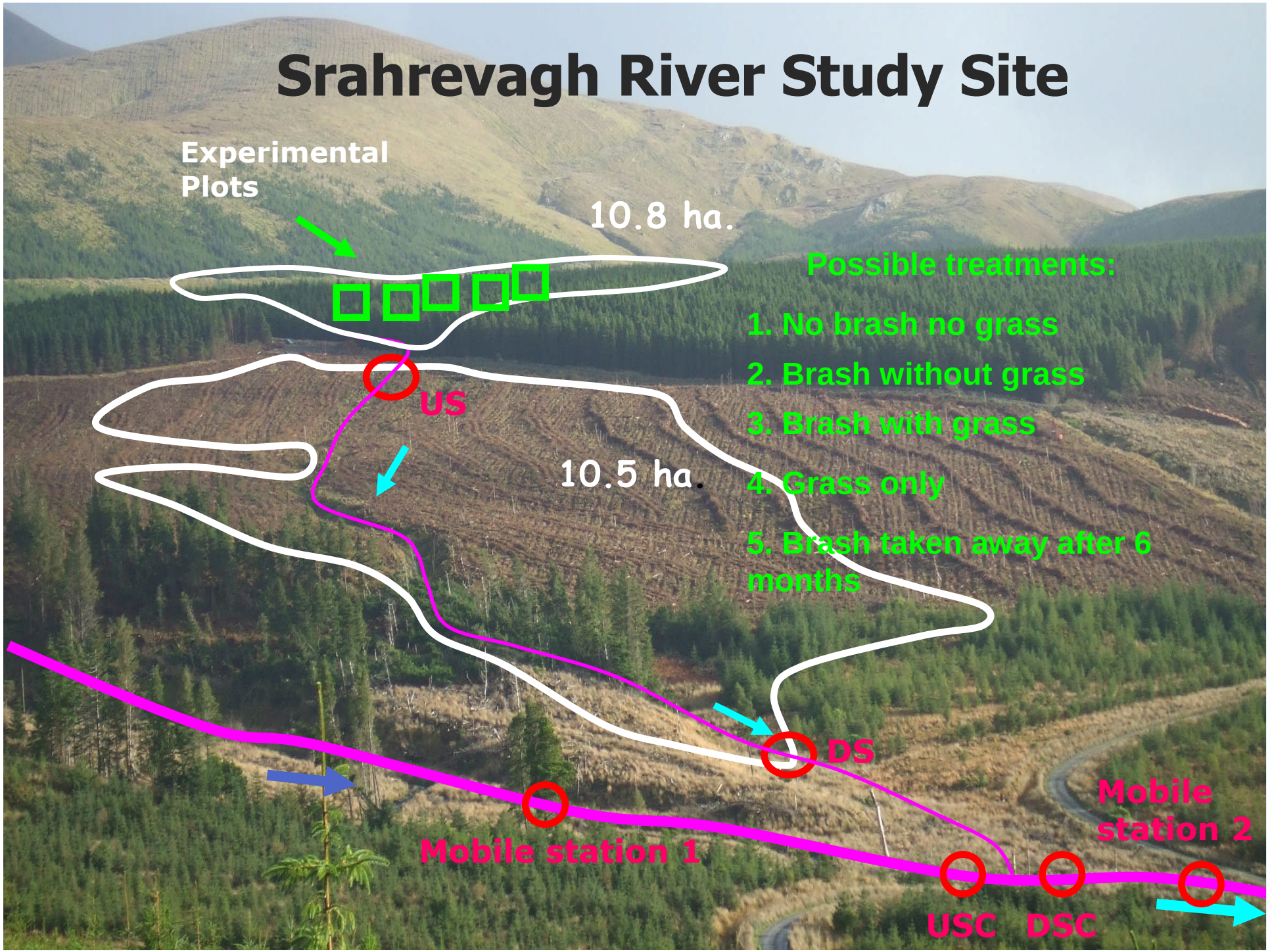
Long term impact of forest harvesting on water quality

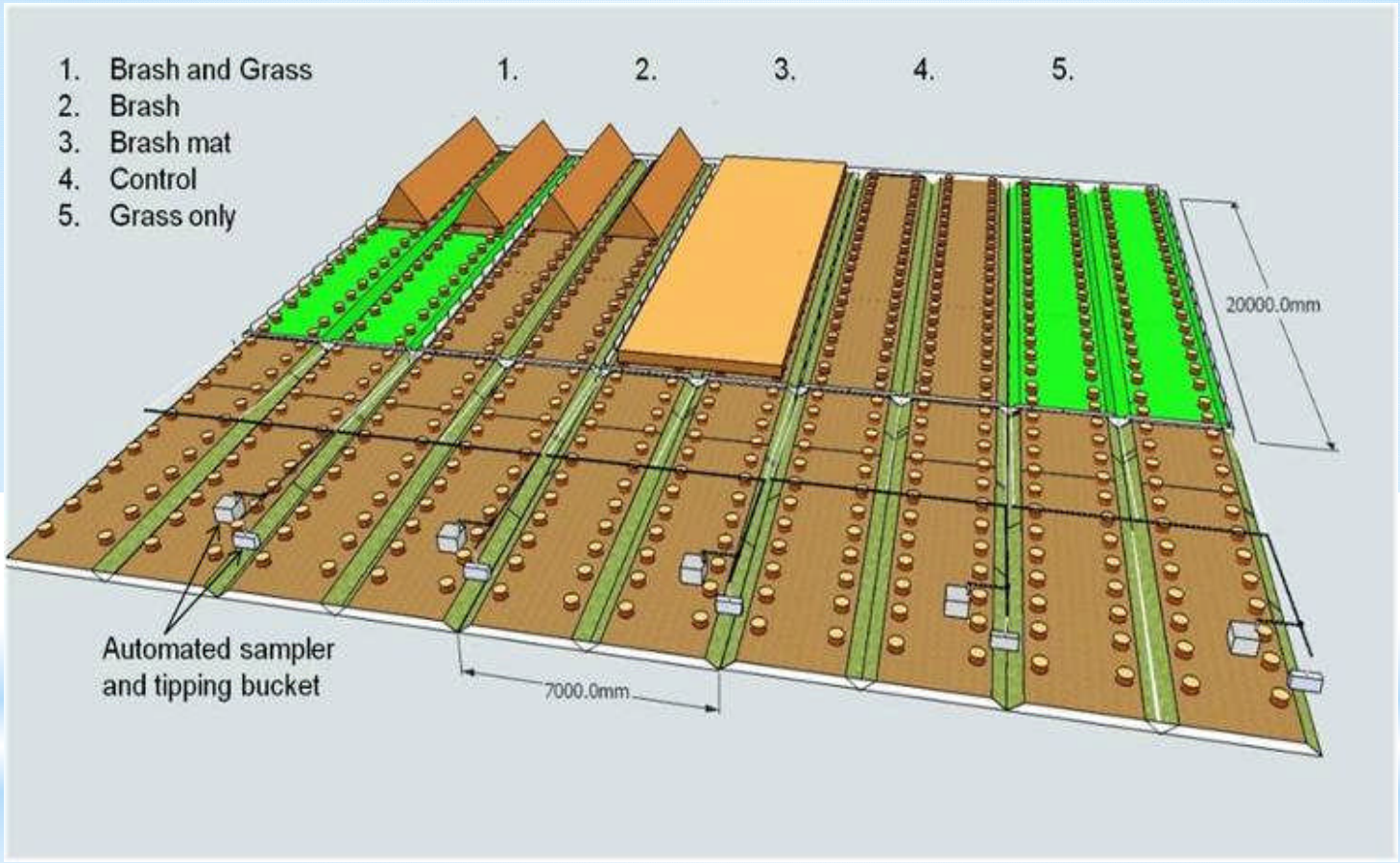
- TRP reached a peak value of about 500 μg/l in Aug. 2006, one year after clearfelling. Important to control P during the first 2 years.

- In Oct. 2009, 4 years after clearfelling, the phosphorus concentration was back to the pre-clearfelling concentration of about 10 μg/l.

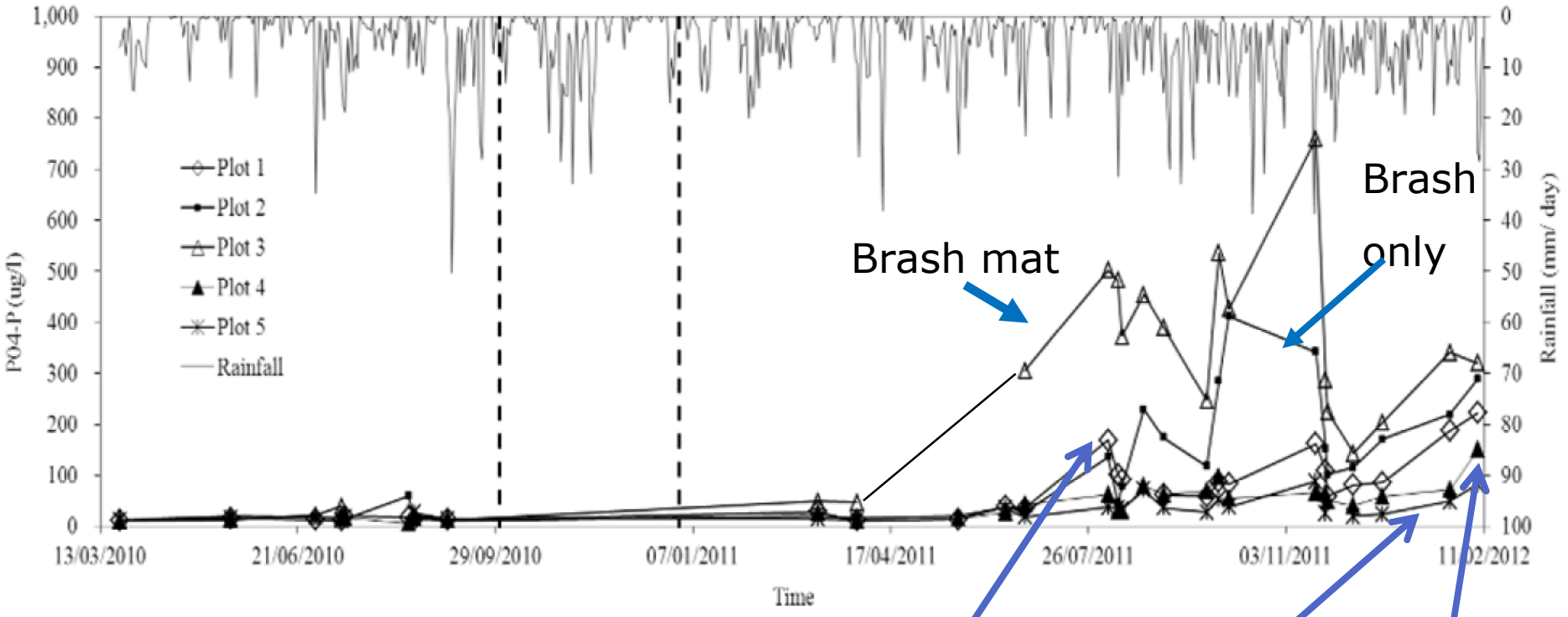
- Because of the dilution capacity, the P concentration in the main river didn't increase significantly during the study period.

*Plot Scale Study


Srahrevagh River Study Site
Experimental Plots
10.8 ha.
Possible treatments:
1. No brash no grass
2. Brash without grass
3. Brash with grass
4. Grass only
5. Brash taken away after 6 months
US
10.5 ha.
DS
Mobile station 1
Mobile station 2
USC
DSC


1. Brash and Grass
2. Brash
3. Brash mat
4. Control
5. Grass only
1.
2.
3.
4.
5.
20000.0mm
Automated sampler
and tipping bucket
7000.0mm

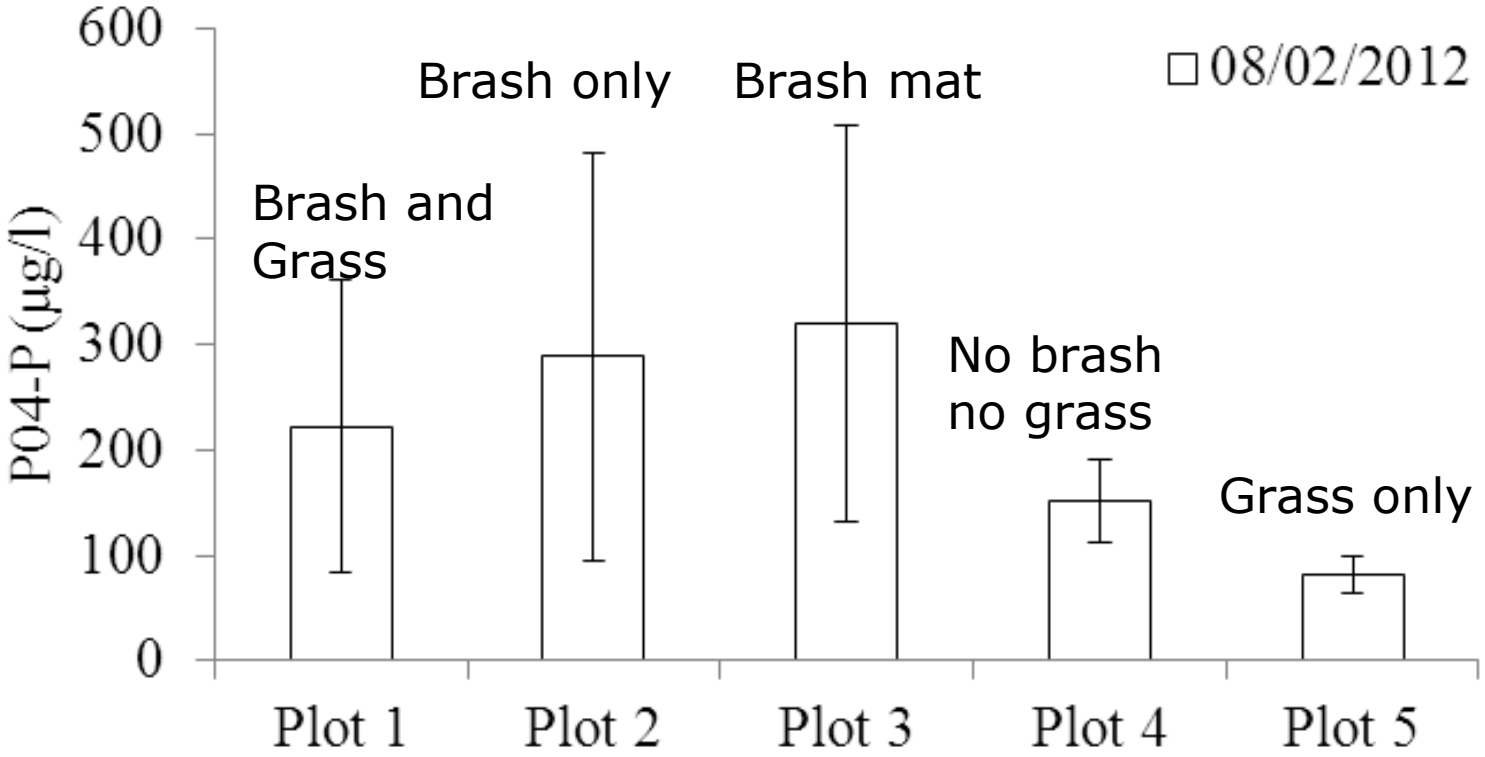
*Plot study result



Plot 1: Brash and Grass; Plot 2: Brash only; Plot 3 Brash mat;

Plot 4: no brash no grass; Plot 5: grass only

*Plot study result

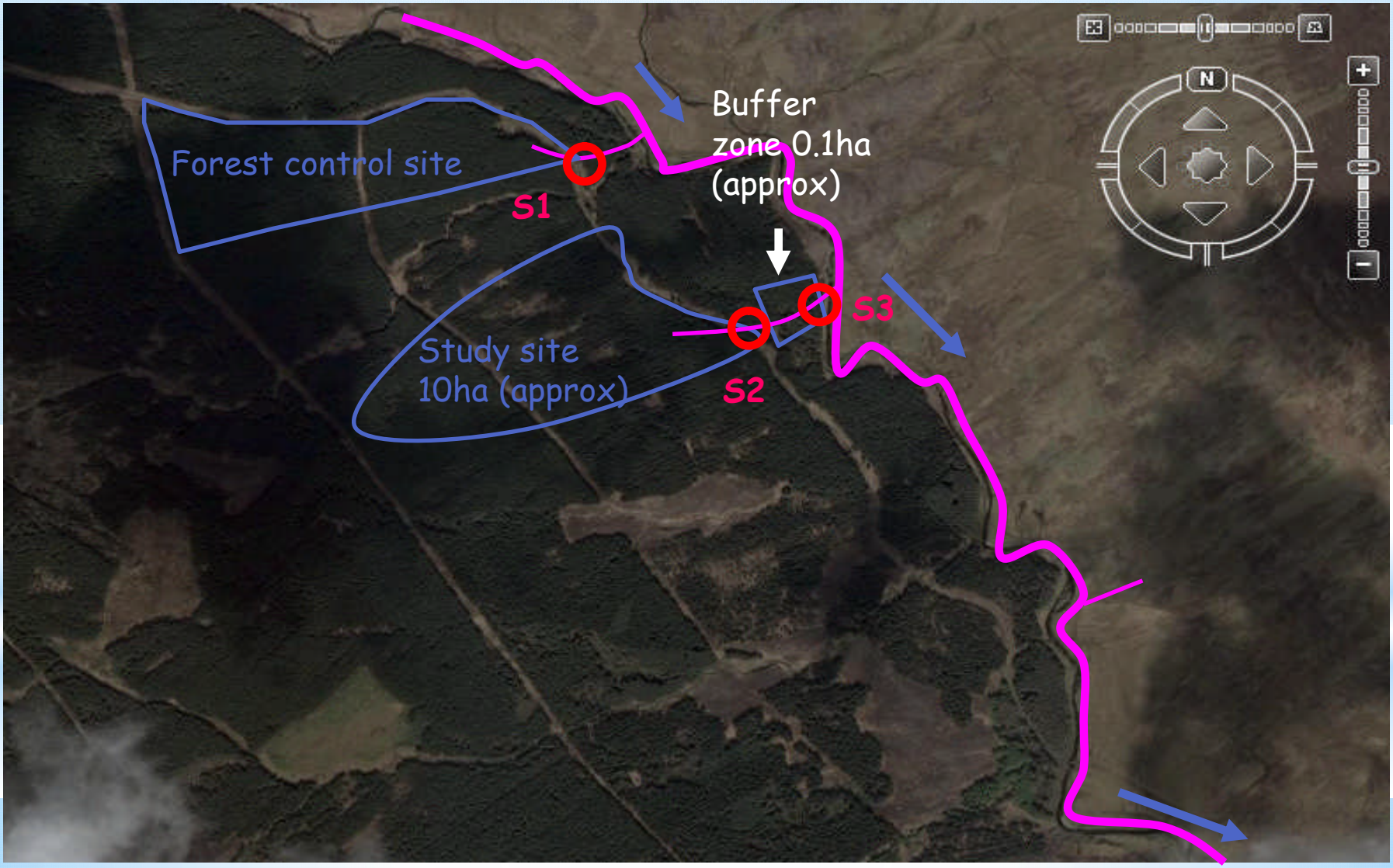


Plot study findings

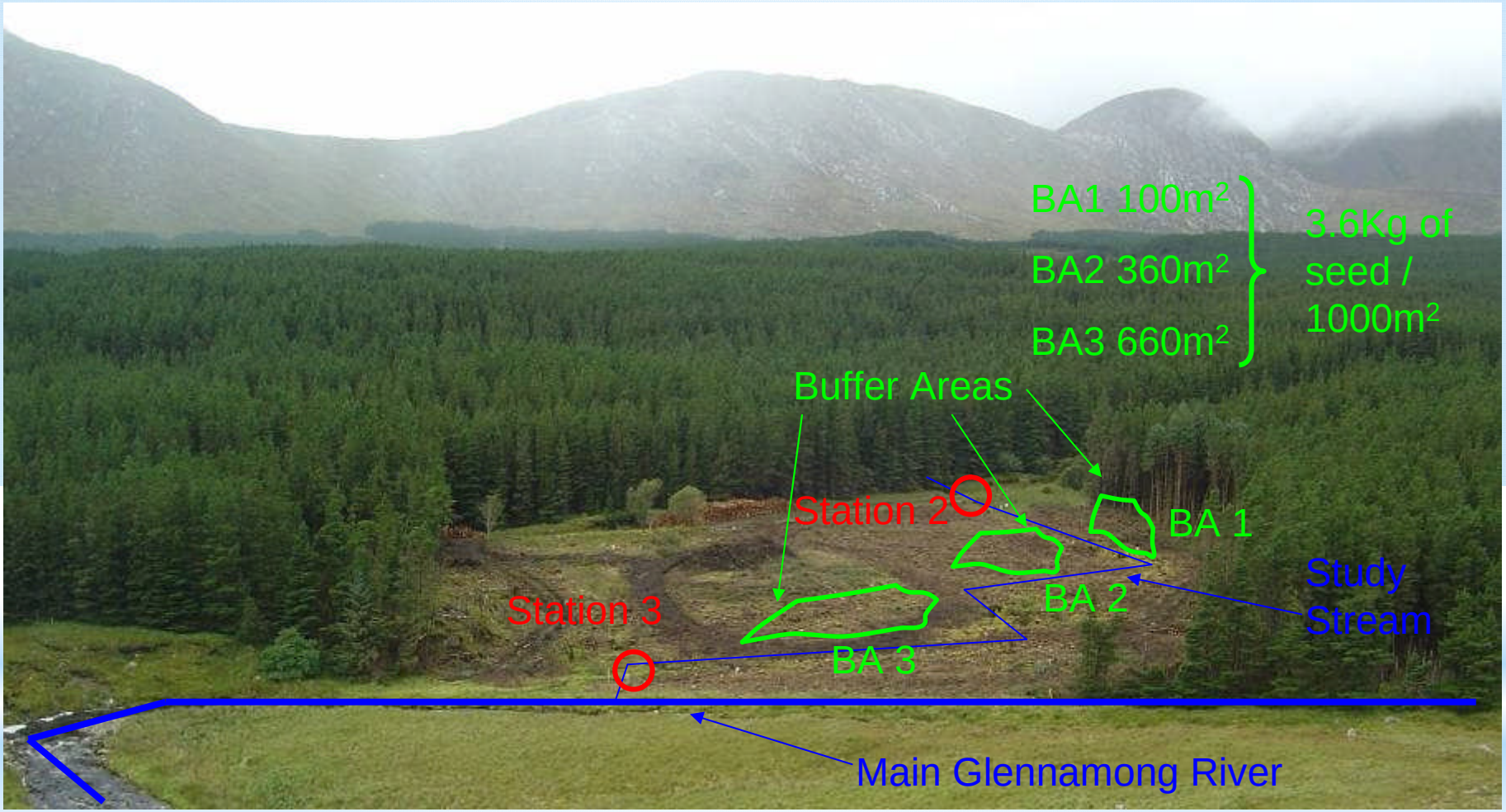
- Brash mat is the most significant nutrient release source after clearfelling
- Brash stockpiles are significant nutrient release sources. This can be reduced by whole-tree-harvesting or grass seeding
- Immediate grassing of the clearfelled sites with native grasses has potential to take up soluble nutrients.

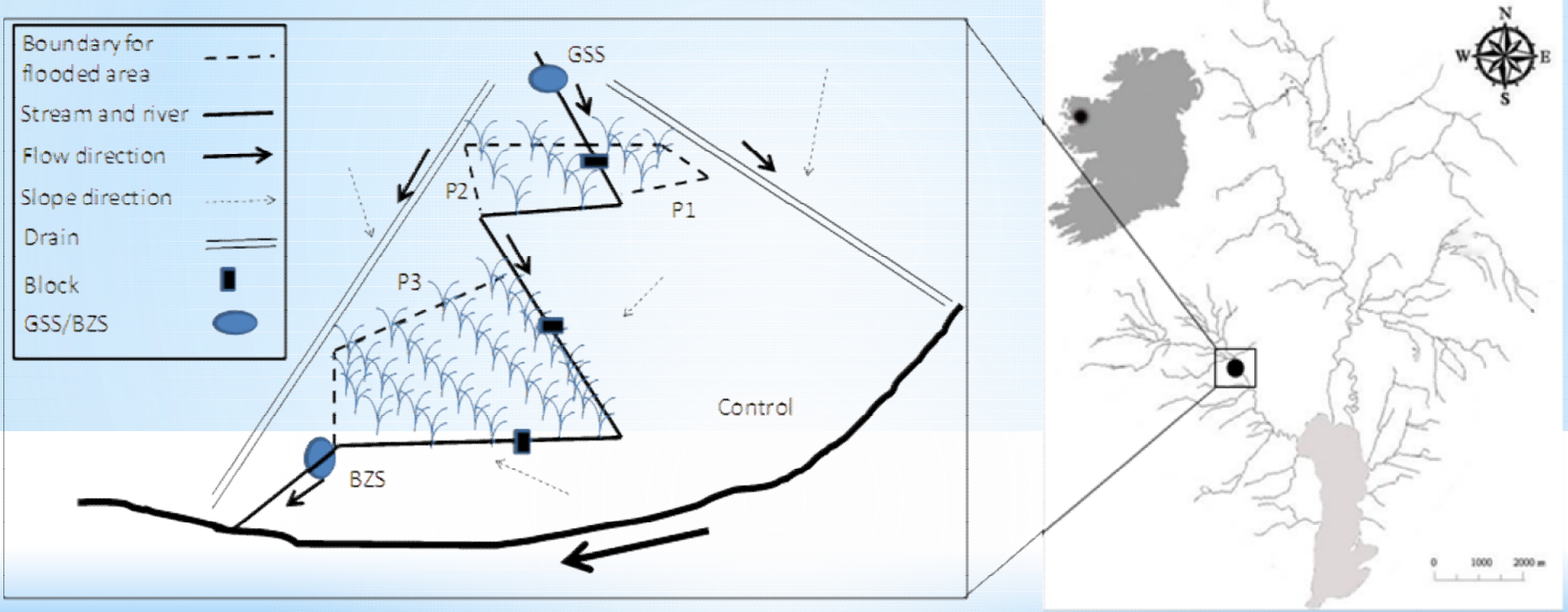
Buffer zone study

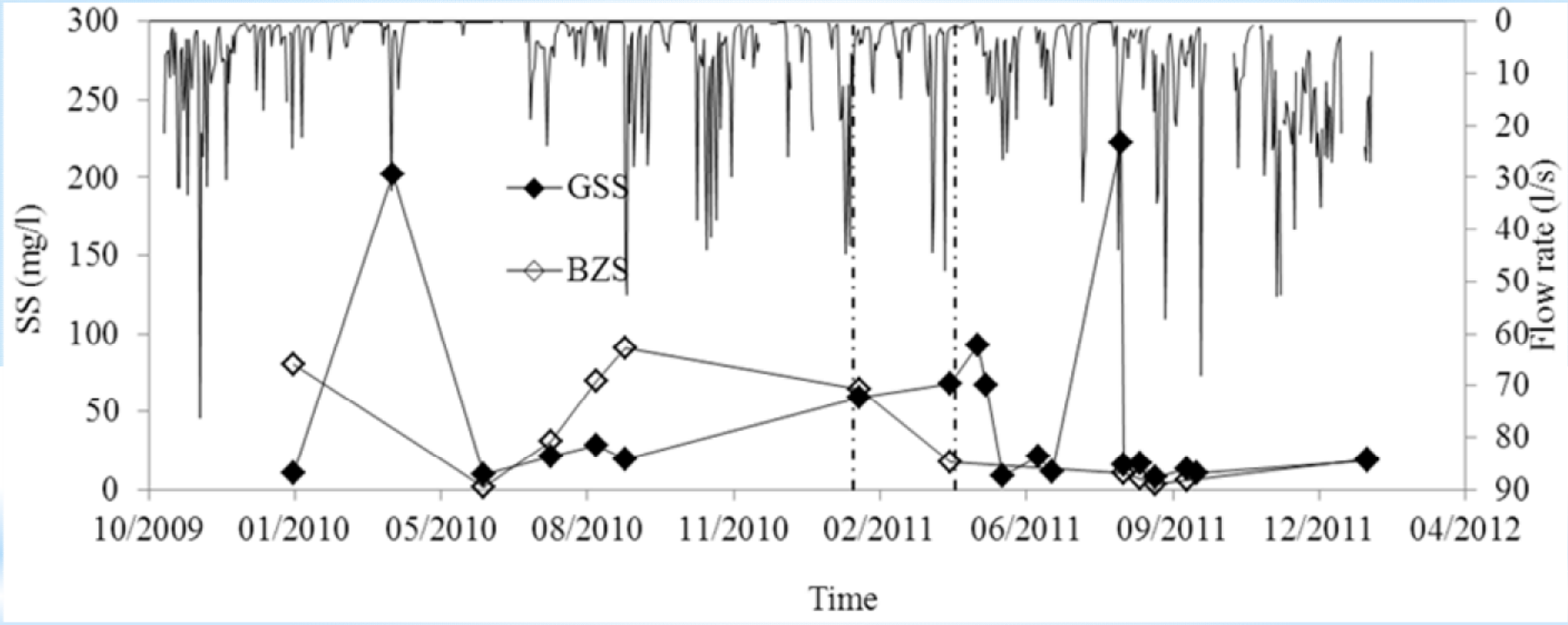
* Glennamong River Study Site

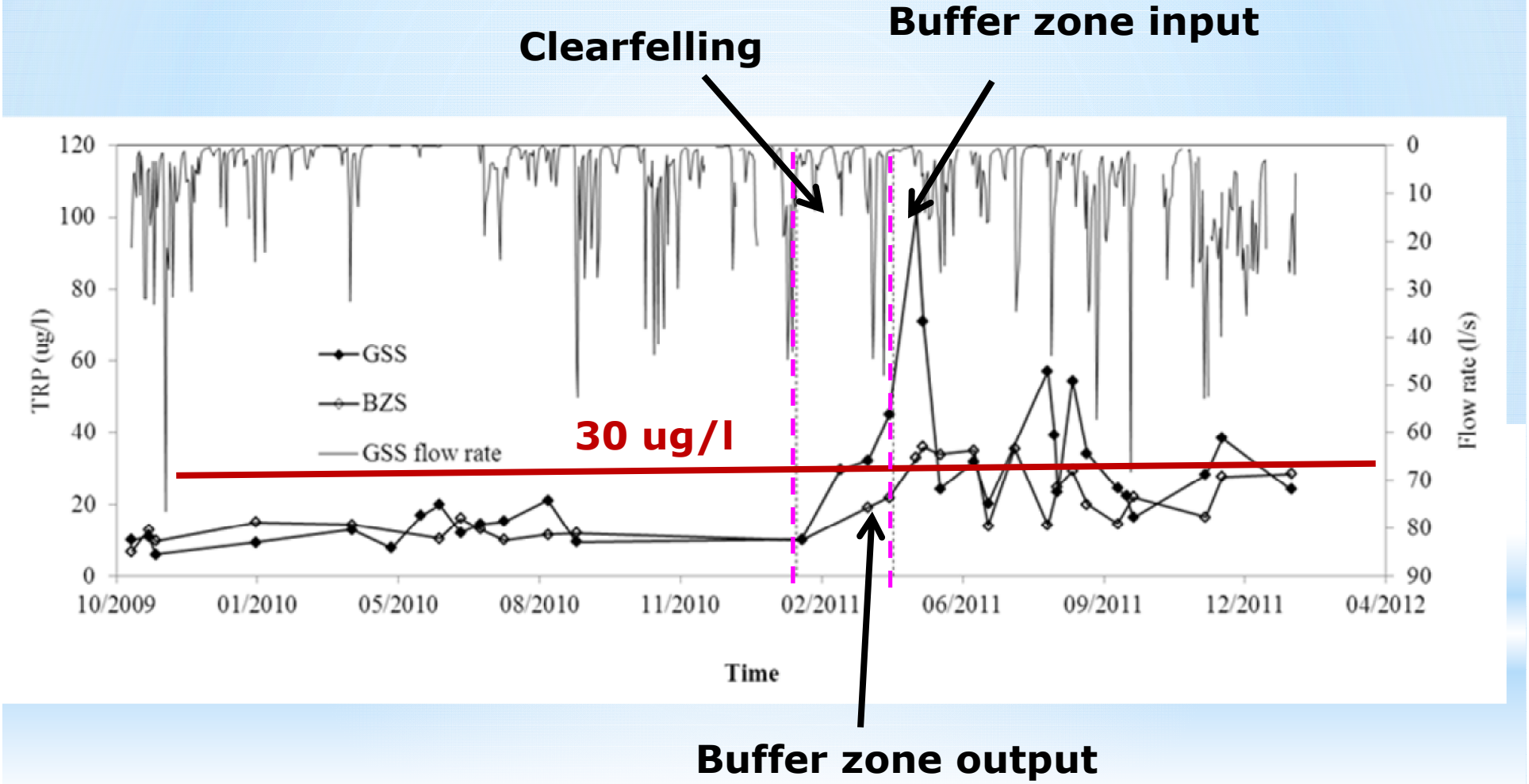


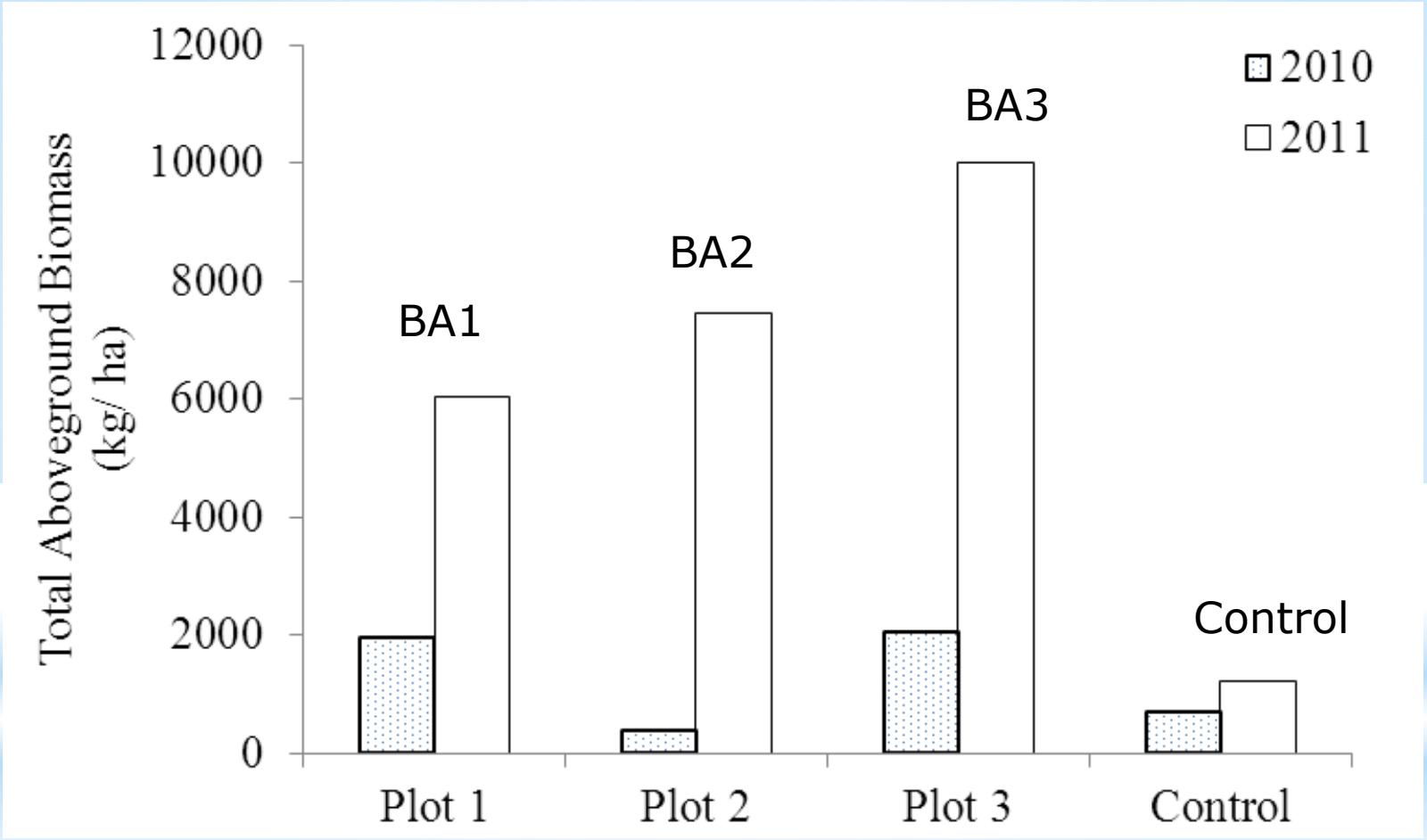
*Glennamong Buffer Area

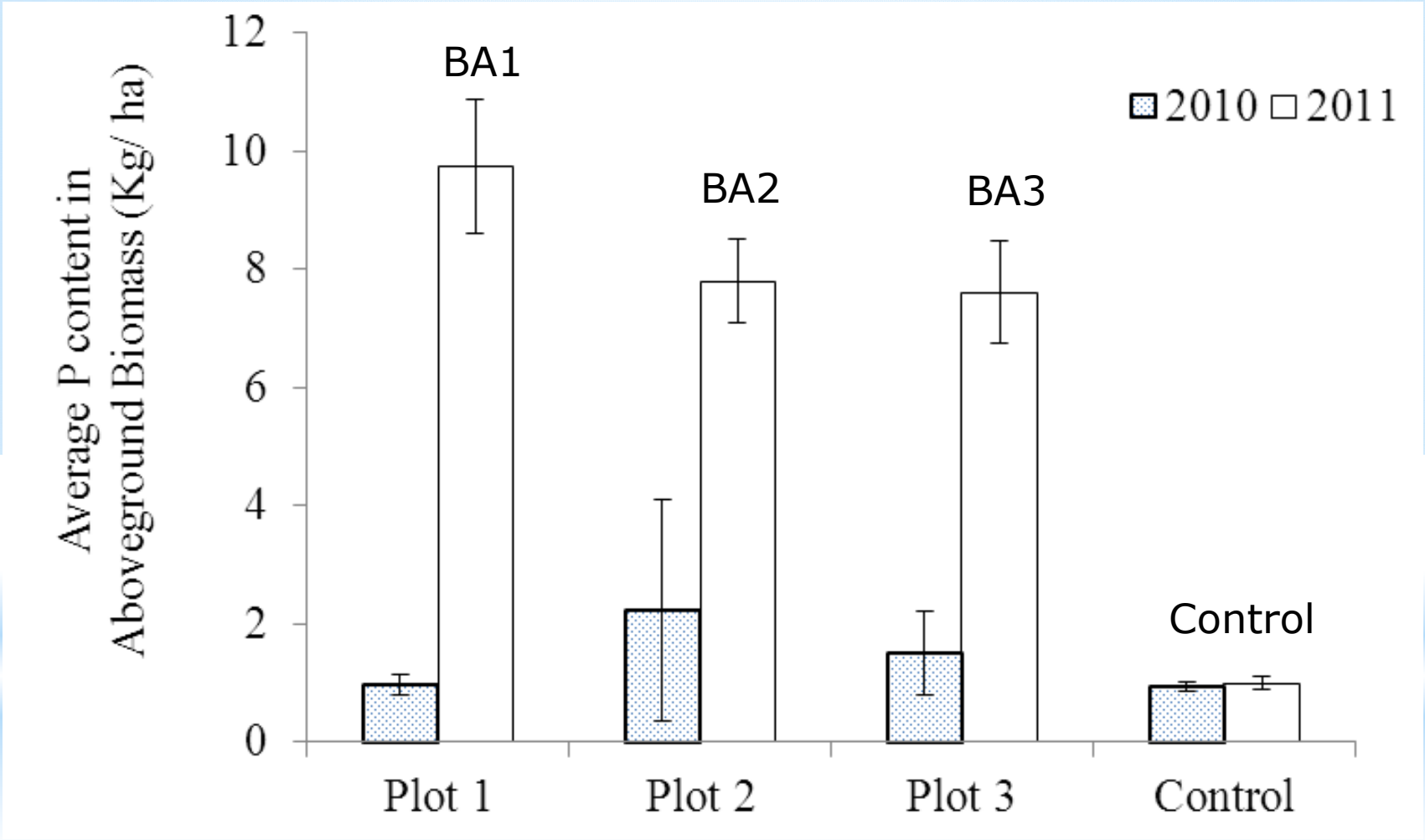



Boundary for flooded area
Stream and river
Flow direction
Slope direction
Drain
Block
GSS/BZS
GSS
P1
P2
P3
Control
BZS
N
W
E
S
0
1000
2000 m


300
250
200
150
100
50
0
SS (mg/l)
GSS
BZS
0
10
20
30
40
50
60
70
80
90
Flow rate (l/s)
10/2009
01/2010
05/2010
08/2010
11/2010
02/2011
06/2011
09/2011
12/2011
04/2012
Time


Clearfelling
Buffer zone input
Buffer zone output
30 ug/l
GSS
BZS
GSS flow rate
TRP (ug/l)
Flow rate (l/s)
Time
120
100
80
60
40
20
0
0
10
20
30
40
50
60
70
80
90
10/2009
01/2010
05/2010
08/2010
11/2010
02/2011
06/2011
09/2011
12/2011
04/2012


Total Aboveground Biomass (kg/ ha)
12000
10000
8000
6000
4000
2000
0
2010
2011
BA1
BA2
BA3
Control
Plot 1
Plot 2
Plot 3
Control


Average P content in Aboveground Biomass (Kg/ ha)
12
10
8
6
4
2
0
BA1
BA2
BA3
Control
2010
2011
Plot 1
Plot 2
Plot 3
Control

Buffer zone findings

- Grass seeding of the buffer zones 1 year before main clearfelling has the potential to reduce release of sediment. However, reducing the release of soluble nutrients is more problematic.

- Engineered buffer strips to create uniform flow distribution is very difficult on hilly ground.