Embrio and Wuiw
two web interfaces for WPS

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Adapted from Jachym Cepický (GRASS goes web: PyWPS 0.1)
http://Les-ejk.cz

ominiverdi

Embrio & Wuiw

- Embrio
  - Technologies: DHTML + AJAX + PHP/Mapscript
  - Scope: an interface based on UMN Mapserver Mapscript to access GRASS functions (Mapserver and WPS on the same server).
  - Dev state: beta
- Wuiw
  - Tecnologie: DHTML + AJAX
  - Scope: an interface as man in the middle between a WPS server and other OWS servers (WCS, WFS) joining remote resources for data and processing.
  - Dev state: alpha

PyWPS in action - WPS Demo

- http://pywps.ominiverdi.org/
  - Repository of demo apps created by ominiverdi.org
  - Developers:
    - Lorenzo Becchi (ominoverde)
    - Luca Casagrande (doktoreas)
  - All applications shown have to be considered under development. If you find a bug, please, post it to PyWPS's mailing list : pywps-devel@wald.intevation.org

Embrio on pywps.ominiverdi.org

Embrio: A new way to see through the GRASS (by doktoreas and ominiverdi)

http://pywps.ominiverdi.org/subversion/trunk/web/

test_los3.png (PNG Image, 5842... | Embrio: A new way to see throug...

EMBRIO - a simple PyWPS AJAX Web Interface

This page is intended to show the development status of a **Web User Interface** for **PyWPS**

Demo applications

- **V.Buffer** - Create a buffer around features of given type (areas must contain centroid).
- **R.Los** - Generates a raster map output in which the cells that are visible from a user-specified observer location are marked with integer values that represent the vertical angle (in degrees) required to see those cells (viewshed)..
- **V.Net.Path** - Find shortest path on vector network.
- **R.walk and r.drain** Find shortest path between 2 points using slope factor as cost value.

Demo applications of ka-Map tool

This applications use ka-Map API to create tiled cache and map navigation. SLD style definition is supported for the WPS output layer.

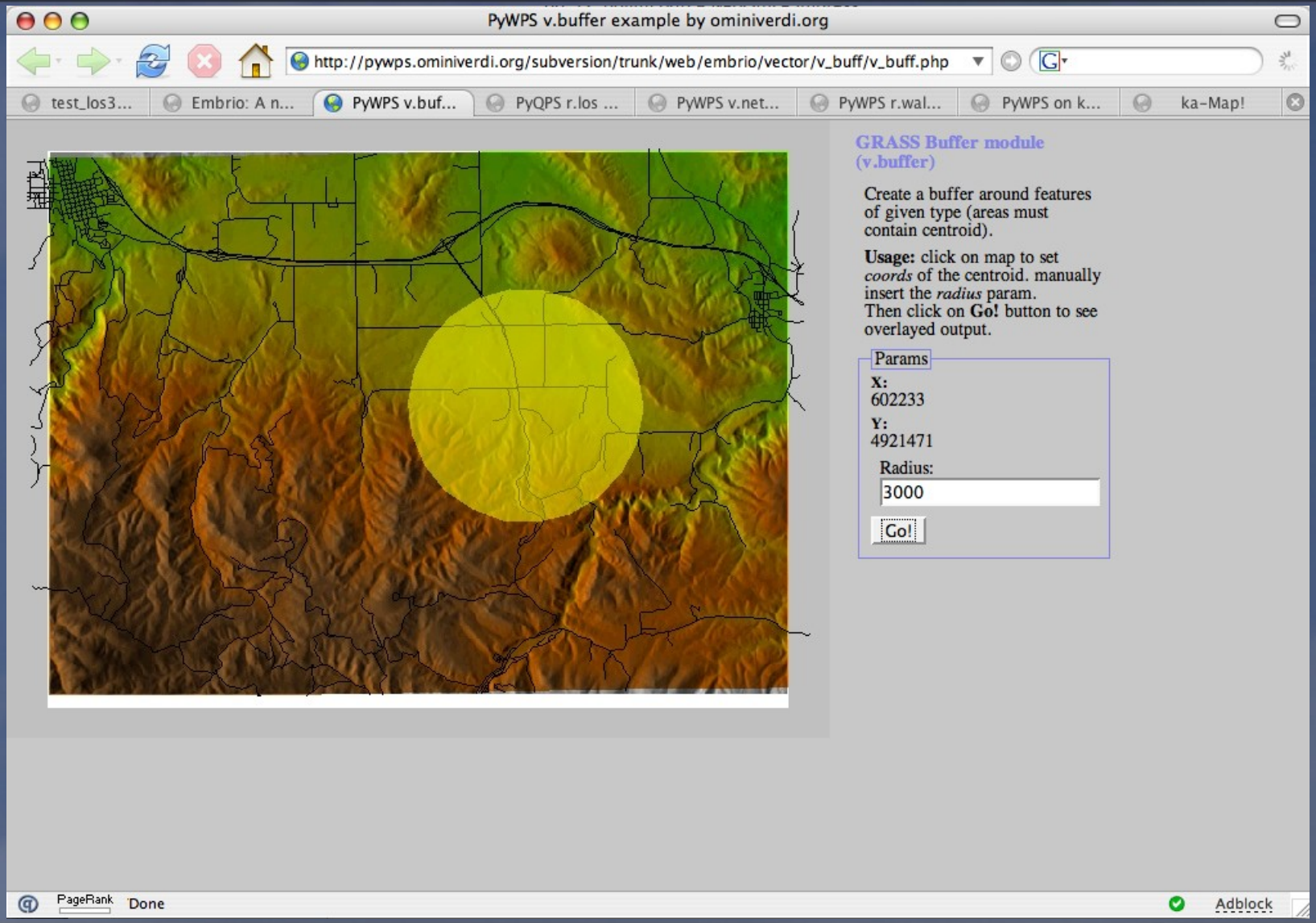
- **R.Los with Embrio interface**
- **R.Los with Winman interface**

Developers

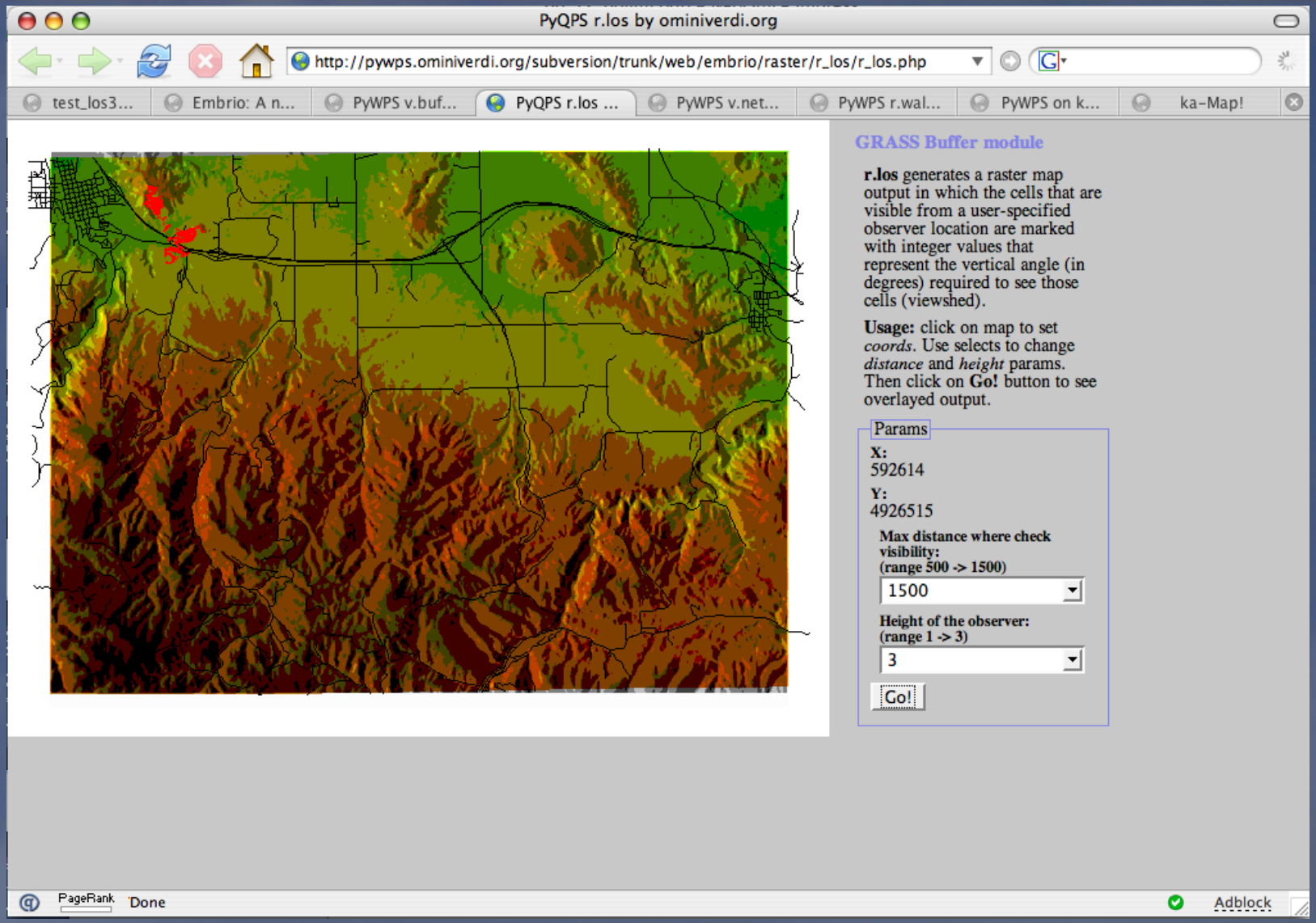
- **doktoreas**
- **ominiverdi**

PageRank Done Adblock

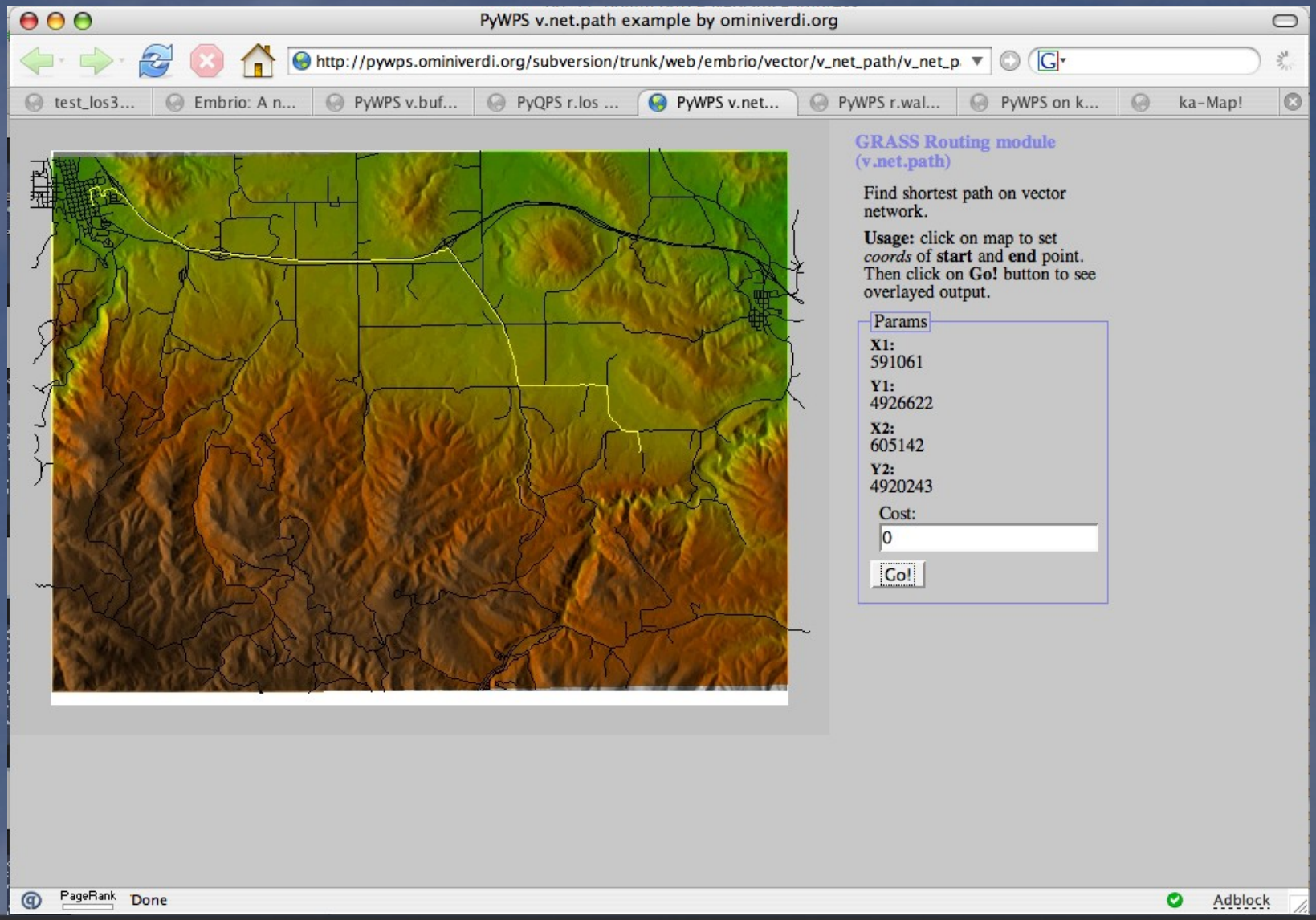
Embrio - V.Buffer



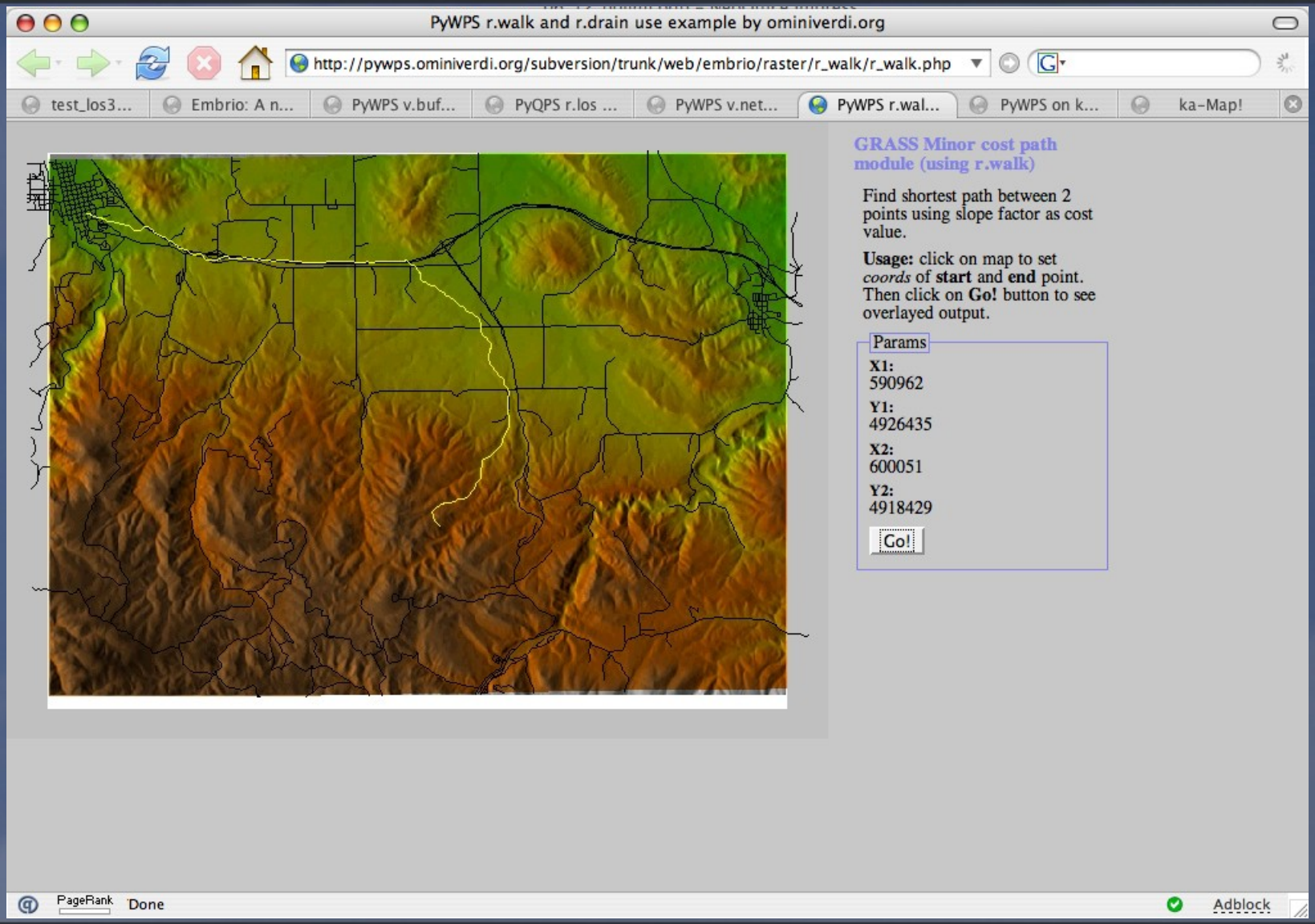
Embrio - R.Los



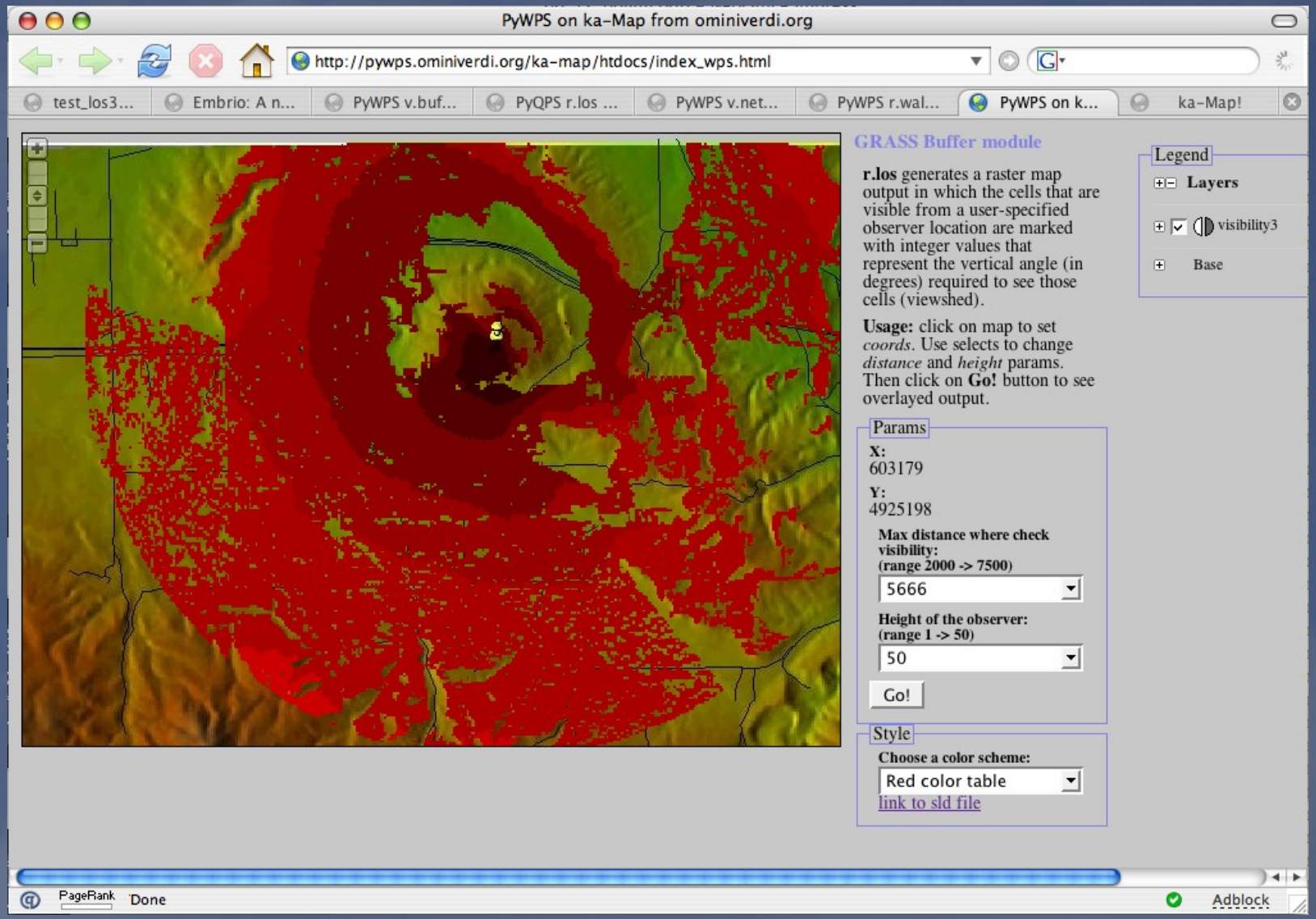
Embrio - V.Net.Path



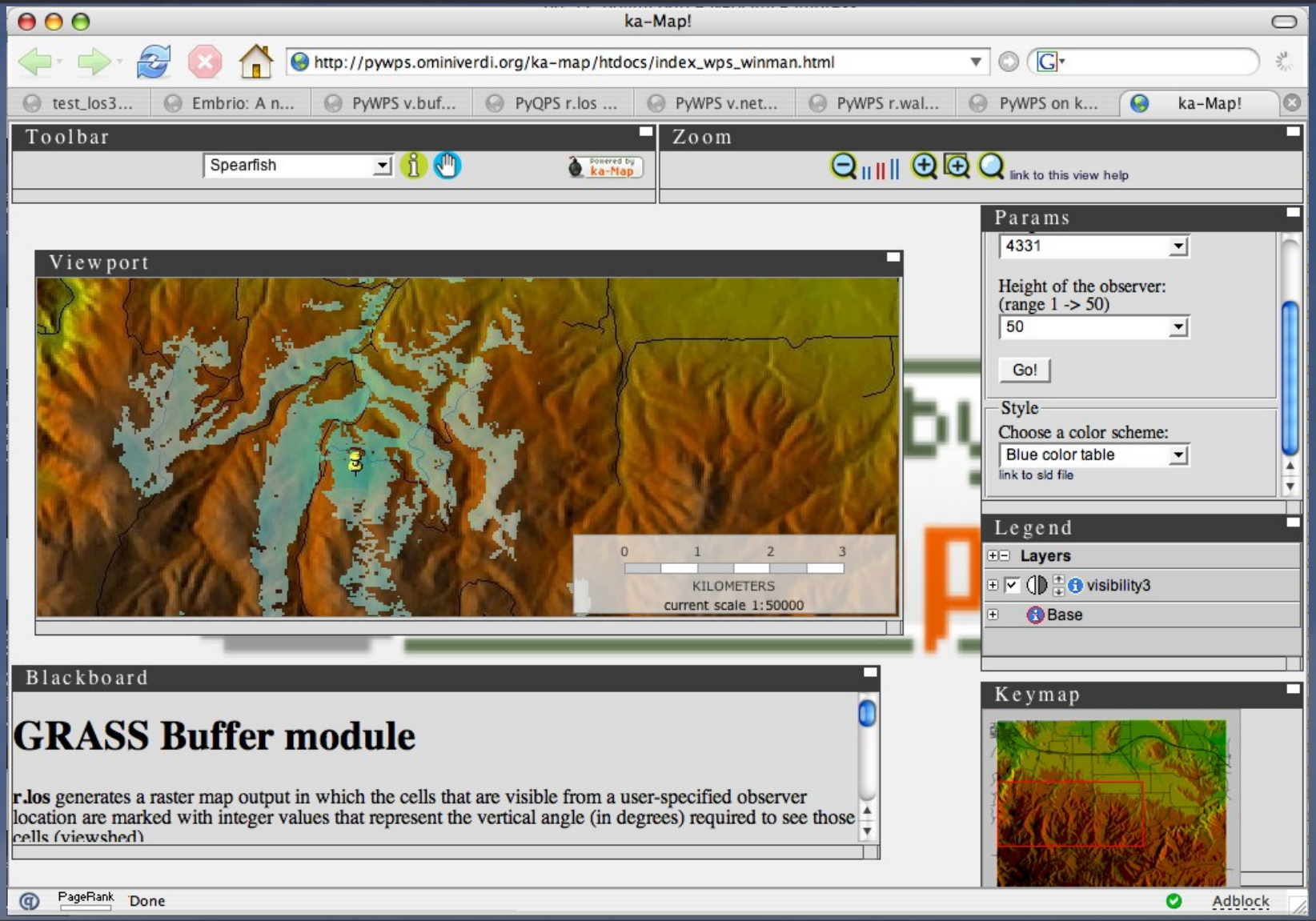
Embrio – R.Walk



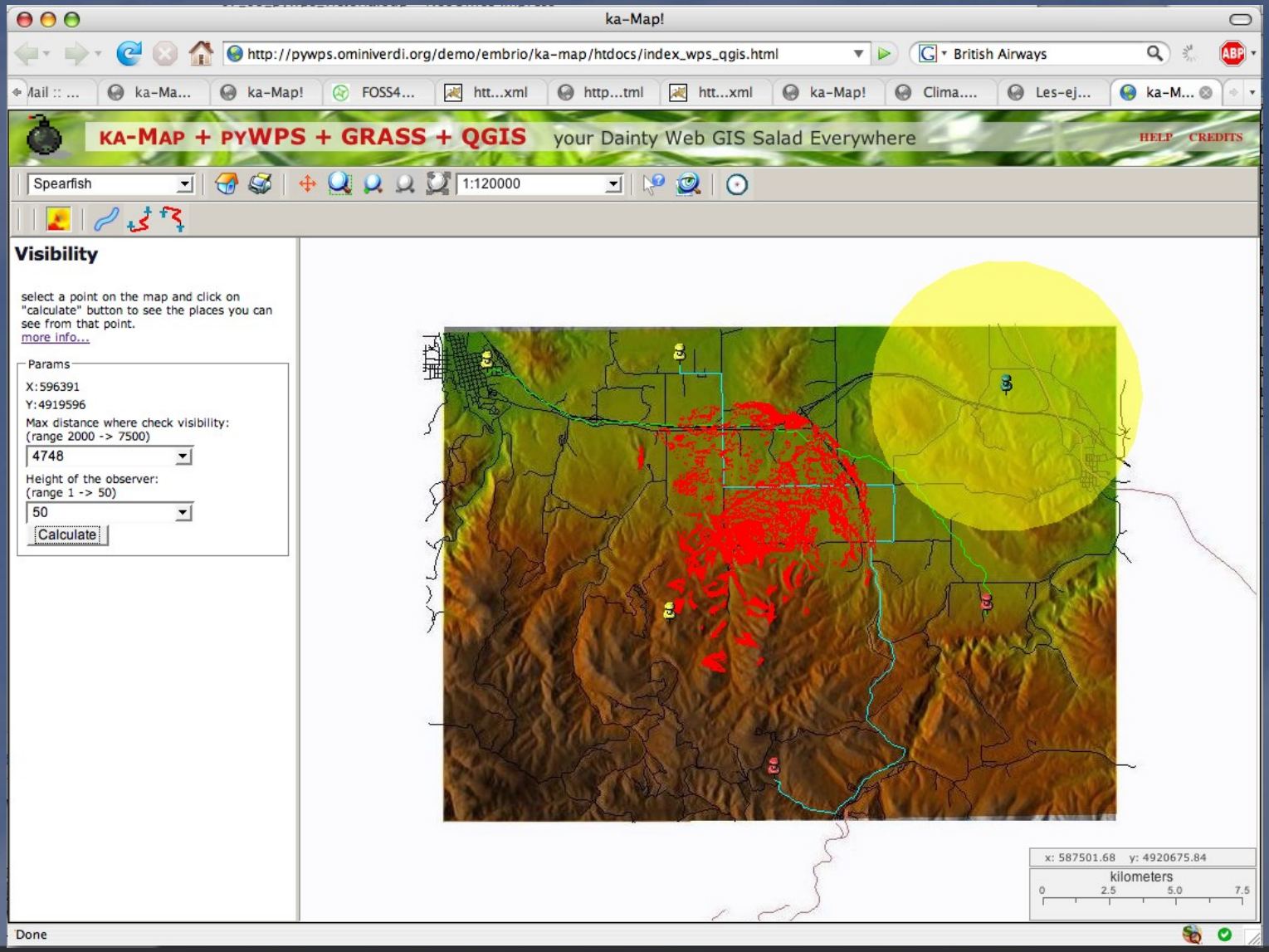
Embrio + ka-Map - R.Los



Embrio + ka-Map + Winman - R.Los



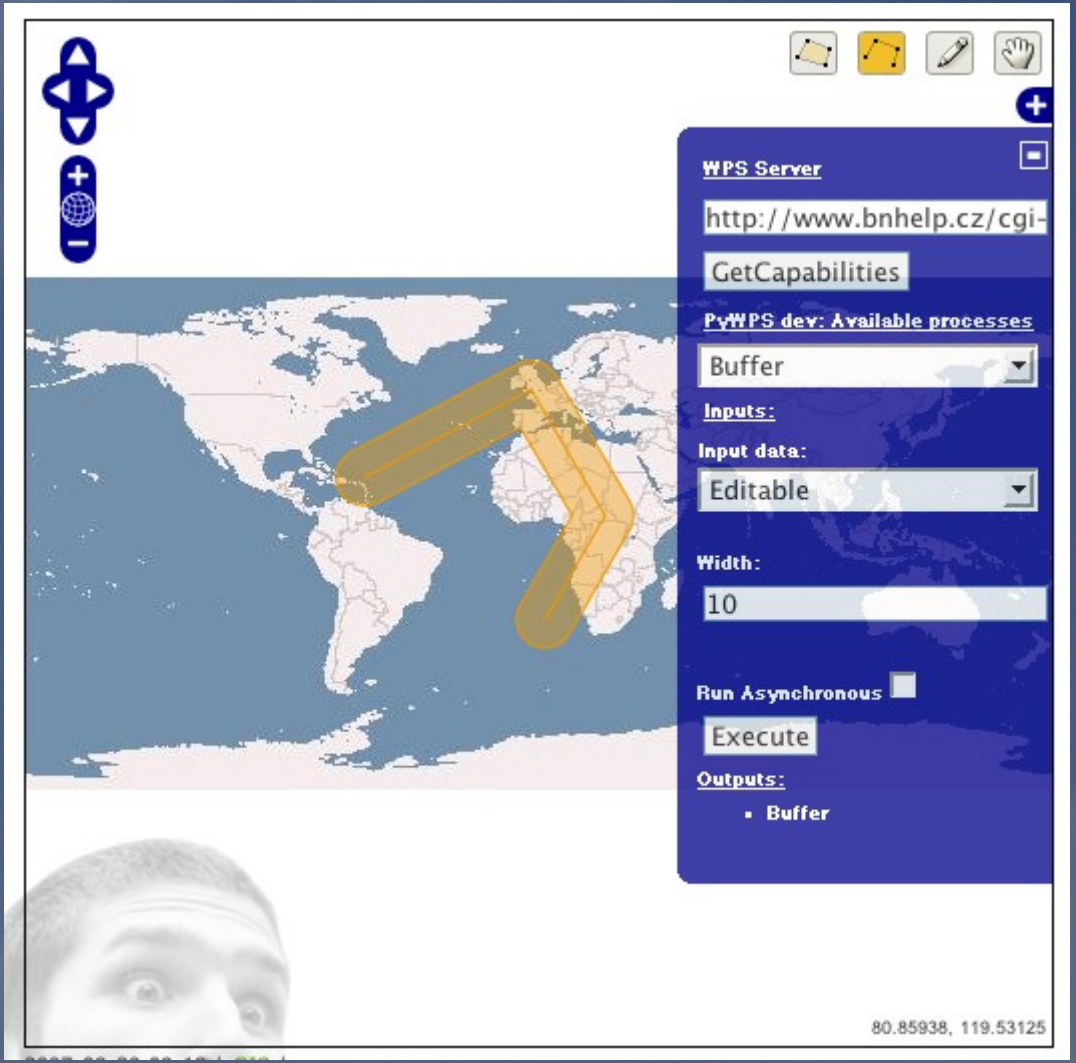
Embrio – last prototype



PyWPS in action - WUIW Demo

- http://www.les-ejk.cz/english/pywps-and-openlayers
  - Code status: Alpha
  - Developers:
    - Jachym Cepicky (ominoverde)
  - Based on OpenLayers API

PyWPS in action - WUIW Demo



Open Geospatial Consortium, Inc (OGC)

- International voluntar y consensus standards organization
- Development and implementation of standards for geospatial content and services
- Active Members: 350 (Sep 2007) – University of Minnesota, US National Oceanic and Atmospheric Administration (NOAA) Coastal Service Center, ESRI, Autodesk Inc., MIT, . . .
- http://www.opengeospatial.org/

Web service

- Software system designed to support interoperable machine-to-machine interaction over a network (Wikipedia)
- In OGC terminology, "Service" refers to a processing task that is invoked by a client and executed by a server, usually across a network.
- The OpenGIS Specifications that make this possible are referred to as "OGC Web Services".
- OpenGIS Web Service (OWS):
  - OpenGIS Catalog Service (CAT)
  - OpenGIS Web Coverage Service (WCS)
  - OpenGIS Web Feature Service (WFS)
  - OpenGIS Web Map Service (WMS)
  - . . .
  - Web Processing Service (WPS) (draft)

OpenGIS Web Processing Service

- Document OGC 05-007r4, version 0.4.0
- Not yet OGC standard, "Discussion Paper", Draft
- To offer any sort of GIS functionality to clients across a network
- XML-based communication protocol
-
- Es: http://pywps.ominiverdi.org/cgi-bin/wps?service=WPS&version=0.4.0&request=...

WPS request=GetCapabilities

http://www.bnhelp.cz/cgi-bin/wps?service=WPS&version=0.4.0&request=GetCapabilities

---

```
<?xml version="1.0" ?>
    <Capabilities version="0.4.0" ... >
        <ows:ServiceIdentification>
        <ows:Title>Sample WPS server</ows:Title>
        <ows:Abstract>WPS for Lausanne</ows:Abstract>
        <ows:ServiceType>WPS</ows:ServiceType>
        <ows:Fees>free</ows:Fees>
        </ows:ServiceIdentification>
        <ows:ServiceProvider>
            <ows:ProviderName>GDF</ows:ProviderName>
            <ows:ServiceContact>
                <ows:IndividualName>Jachym Cepicky</ows:IndividualName>
                <ows:PositionName>Student</ows:PositionName>
                ...
            </ows:ServiceContact>
        </ows:ServiceProvider>
...
```

WPS request=GetCapabilities


```
...
<ProcessOfferings>
    <Process processVersion="0.1">
        <ows:Identifier>addvalue</ows:Identifier>
        <ows:Title>Add some value to raster map</ows:Title>
    </Process>
    <Process processVersion="0.1">
        <ows:Identifier>classify</ows:Identifier>
        <ows:Title>Image classification</ows:Title>
        <ows:Abstract>
            GRASS processed imagery
            classification. Only unsupervised is supported at the moment.
        </ows:Abstract>
    </Process>
    <Process processVersion="0.1">
        <ows:Identifier>shortestpath</ows:Identifier>
        <ows:Title>Shortest path</ows:Title>
    </Process>
</ProcessOfferings>
```

WPS request=DescribeProcess

http://www.bnhelp.cz/cgi-bin/wps.py?service=WPS&version=0.4.0&
request=DescribeProcess&identifier=addvalue

```
<?xml version="1.0" ?>
    <ProcessDescriptions ...>
        <ProcessDescription ...>
            <ows:Identifier>addvalue</ows:Identifier>
            <ows:Title>Add value</ows:Title>
            <ows:Abstract>Adds some value to each cell of input raster map</ows:Abstract>
            <DataInputs>
                <Input>
                    <ows:Identifier>value</ows:Identifier>
                    <ows:Title>Value to be added</ows:Title>
                    <LiteralData>
                        <AllowedValues>
                            <Value>1</Value>
                            ...
                        </AllowedValues>
                        <ows:DefaultValue>10</ows:DefaultValue>
                    </LiteralData>
                </Input>
...
```

WPS request=DescribeProcess

```
            <Input>
                <ows:Identifier>map</ows:Identifier>
                <ows:Title>Input raster map</ows:Title>
                <ComplexData defaultFormat="image/tiff">
                </ComplexData>
            </input>
        </DataInputs>
        <ProcessOutputs>
            <Output>
                <ows:Identifier>value</ows:Identifier>
                <ows:Title>literal value + 1</ows:Title>
                <LiteralOutput> ... </LiteralOutput>
            </Output>
            <Output>
                <ows:Identifier>map</ows:Identifier>
                <ows:Title>Resulting output map</ows:Title>
                <ComplexOutput defaultFormat="image/tiff">
                    ...
                </ComplexOutput>
            </Output>
        </ProcessOutputs>
    </ProcessDescription>
</ProcessDescriptions>
```

WPS request=Execute

http://www.bnhelp.cz/cgi-bin/wps.py?service=WPS&version=0.4.0&
request=Execute&identifier=addvalue&DataInputs=value,5,map,http://localhost/data/soils.tif

---

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
    <Execute service="wps" version="0.4.0" store="true" status="false"
            xmlns="http://www.opengeospatial.net/wps"
            xmlns:ows="http://www.opengeospatial.net/ows">
        <ows:Identifier>addvalue</ows:Identifier>
        <DataInputs>
            <Input>
                <ows:Identifier>value</ows:Identifier>
                <LiteralValue>5</LiteralValue>
            </Input>
            <Input>
                <ows:Identifier>map</ows:Identifier>
                <ComplexValueReference  reference="http://localhost/data/soils.tif" />
            </Input>
            ...
        </DataInputs>
    </Execute>
```

WPS Response XML


```
<?xml version="1.0" ?>
    <ExecuteResponse ...>
        <ows:Identifier>addvalue</ows:Identifier>
        <Status>
            <ProcessSucceeded/>
        </Status>
        <ProcessOutputs>
            <Output>
                <ows:Identifier>value</ows:Identifier>
                <ows:Title>literal value + 1</ows:Title>
                <LiteralValue>6</LiteralValue>
            </Output>
            <Output>
                <ows:Identifier>value</ows:Identifier>
                <ows:Title>Resulting output map</ows:Title>
                <ComplexValueReference format="image/tiff"
        ows:reference="http://www.bnhelp.cz/wpsoutputs/output2-2006-8-21-14-54-42.tif"
                />
            </Output>
        </ProcessOutputs>
    </ExecuteResponse>
```

PyWPS 2.0

- Implementation OGC's WPS standard (90-95 %)
- CGI Application
- Python programming language

PyWPS 2.0

- PyWPS starts as dedicated connector to GRASS
  - CLI
  - More than 300 modules for raster and vector analysis
  - GNU/GPL
  - GRASS Functionality can be via PyWPS offered in Internet
- User does not need Desktop-GIS (GRASS, ESRI, Idrisi, ...) – Web browser becomes GIS
- One can use other CLI-oriented programs (PROJ.4, GDAL, R, ...)

PyWPS 2.0 – Execute – how it works

- Controlling input data, if all necessar y parameters have arrived (Identifier, DataInputs,. . .)
- Loading process, for each input:
  - LiteralValue: Controlling, if input fits AllowedValues array
  - ComplexValue: Embed input files will be extruded from input XML request into separate files
  - ComplexValueReference: Tries to download the data from external source and stores it to new file
  - BoundingBoxValue
- If some DataInput is missing, it looks for the default value value

PyWPS 2.0 – Execute – how it works

- Creates temporar y GRASS Location or just temporar y Mapset within existing location, which will be deleted, after the work is done
- Calls function execute() of the process
- Formulates output XML file
- Deletes temporar y files (location, mapset, pid file)
- Returns output XML or resulting map file (TIFF, GML) to the client
- Process can be run asynchronously: After the request is accepted, XML responce is imidietly returned with <ProcessAccepted /> element and the calculation is forked to background.

PyWPS 2.0 - Addvalue – Sample process

- Inputs
  - Literal input: il valore da aggiungere
  - ComplexValueReference input: una mappa raster
- Outputs
  - Literal output: Input+1
  - ComplexValueReference: la mappa risultante (GeoTIFF)

PyWPS 2.0 – Sample process

```
class Process:
  def __init__(self):
        self.Identifier = "addvalue"
        self.Title="Sample process for demonstration purposes"
        self.Inputs = [ { # 0
                              'Identifier':'value',
                              'Title': 'Value to added',
                              'LiteralValue': {'values':[0,1,2,3,4,5]},
                              'dataType': type(0),
                              'value':0, # default},
                        { #1
                              'Identifier': 'map',
                              'Title': 'The raster map',
                              'ComplexValueReference': {'Formats':["image/tiff
                        }... ]
        self.Outputs = [ { # 0
                              'Identifier': 'value',
                               'Title': 'Input value + 1',
                              'LiteralValue': {},
                              'value':1 },... ]
```

PyWPS 2.0 – Sample process

```
29          def execute(self):
30              self.status = ["The start", 5]
31              self.Outputs[0]['value'] = self.Inputs[0]['value']+1
32              self.status = ["LiteralValue set", 20]
33
34          self.status = ["Data import", 25]
35          os.system("r.in.gdal in=%s out=map" % (self.Inputs[1]['value'
36
37          self.status = ["Creating output map", 50]
38          os.system("r.mapcalc map=map+%d" % (self.Inputs[0]['value']))
39
40          self.status = ["Exporting map", 75]
41          if os.system("r.out.gdal in=map out=output.tif type=UInt16 >
42          return "Could not export map"
43          else: # ok
44          return
```

Conclusions

- WPS Standard implemented to usable degree
- Making GRASS scripts run via web-interface was never easier
- It is relatively simple to connect UMN MapServer (or ARC IMS) with GRASS via PyWPS. Fur ther GRASS development will make this even easier

Sviluppi futuri

- PyWPS
- Process definition (data inputs and outputs) is primitive – build set of classes for process definition
- GRASS
  - Implementation of new GRASS-python interface (Alessandro Frigeri aka ’geoalf ’)
  - 3D views via VTK (Sören Gebbert aka ’huhabla’)
- Embrio & Wuiw
  - Road to stable versions

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