Evaluating Volunteered Geographic Information as a data source for Location-based Services

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Prepared with only

Data and Location-based Services

- Data layer is assumed to be “ubiquitous” by many developers of LBS
- Navteq, Teleatlas, Google (advertising + API use), local or national WMS, geo-services, etc
- Many LBS are developed “locally” with *national* or *global* deployment in mind …
- OSM and VGI – global spatial coverage, “white spaces on the map”, inhomogeneous spatial representation, metadata, ….

Key messages from this presentation

- OpenStreetMap is a very exciting mapping/cartographical project based on VGI/Crowdsourcing
- **Assertion 1:** The OSM database/map for any location “evolves” in a non-linear (un-predictable) manner.
- **Assertion 2:** Just as in Wikipedia – tagging conflicts/mis-understandings occur
- **Assertion 3:** The current “state-of-the-map” can be an unreliable indicator of overall “*quality*”

Substantial literature on VGI is beginning to appear

- "*VGI relies on simplification of contribution – Flickr, Foursquare, Wikimapia, etc*" (Girres and Touya, 2010)
- "*Proliferation of spatial information – vision of a spatially enabled society*" (Ho and Rajabifard, 2010)
- "*VGI could be a 'barometer' for people's concerns and attitudes and inform open data*" (Ho and Rajabifard, 2010)
- "*VGI contributors are occasional, interested amateurs*" (Coleman et al, 2009)

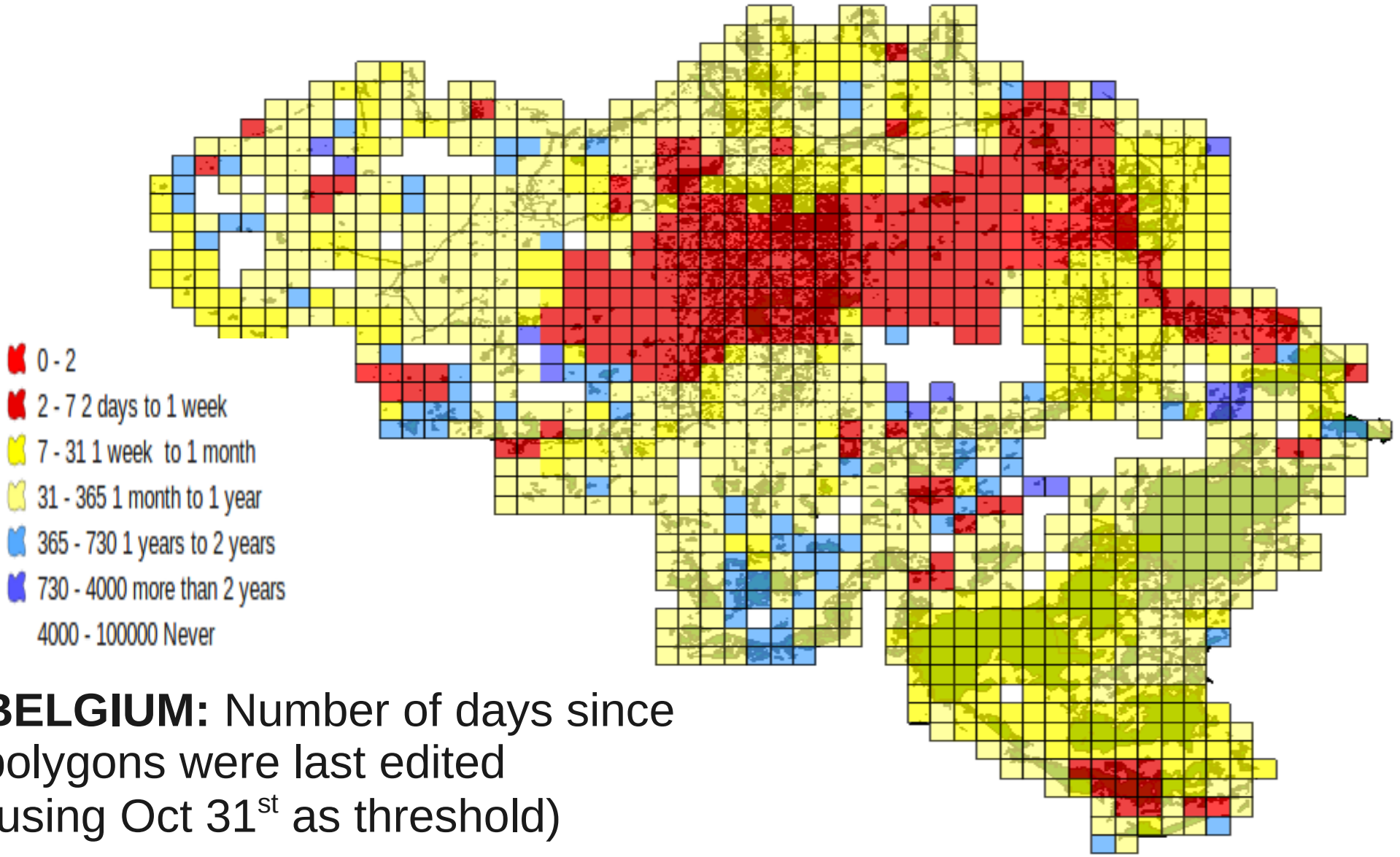
Quality of VGI and OSM is now a "hot topic" in GIS research

- "*Neogeographers are reluctant to work according to specifications*" (Brando and Bucher, 2010)
- "*Introducing tough quality control could be a 'Kill Joy' in VGI*" (Girres and Touya, 2010)
- "*What is missing is a framework to classify VGI products and sources and domains where they (are/can be) used*" (Ostlander et al, 2010)
- "*Instead of determining usefulness of spatial data via quality/fitness for use … usability and satisfying consumer needs is equally important*" (Triglav et al, 2011)

Several academic studies have analysed OSM quality against ground-truth datasets

- **Mooney et al (2010)** – "*OSM shape geometric for physically inaccessible features is very poo*r"
- **Haklay (2010)** "*on average within about 6 m of the position recorded by the OS, and with approximately 80% overlap of motorway objects between the two datasets*"
- **Over et al (2010)** – building 3-D models in Germany with OSM "*Too inhomogeneous to be used for serious geomatics*"
- **Zielstra and Zipf (2010)** – OSM Germany vrs Teleatlas - "*as good as, if not surpassing, the commercial equivalent in major German cities*"
- **Girres and Touya (2010)** – France – geometric accuracy very good but several lack of documentation and metadata

Country Level Heat Maps – 5KM Grid - Belgium



BELGIUM: Number of days since polygons were last edited (using Oct 31st as threshold)

Working With OpenStreetMap

OpenStreetMap XML is a simple format to understand and process

```
<?xml version="1.0" encoding="UTF-8"?>
<osm version="0.6" generator="OpenStreetMap server">
  <way id="29712712" visible="true" timestamp="2009-01-05T17:01:36Z" user="SK53" uid="84681" version="1" changeset="738029">
    <nd ref="327338584"/><nd ref="327338587"/><nd ref="327338590"/>
    <nd ref="327338593"/><nd ref="327338596"/><nd ref="327338598"/>
    <nd ref="327338600"/><nd ref="327338604"/><nd ref="327338607"/>
    <nd ref="327338610"/><nd ref="327338584"/>
    <tag k="building" v="yes"/>
    <tag k="created_by" v="Potlatch 0.10f"/>
    <tag k="name" v="Sir Colin Campbell Building"/>
  </way>
  <way id="29712712" visible="true" timestamp="2009-01-06T13:20:49Z" user="SK53" uid="84681" version="2" changeset="744302">
    <nd ref="327338584"/><nd ref="327338587"/><nd ref="327338590"/>
    <nd ref="329127305"/><nd ref="327338593"/><nd ref="327338596"/>
    <nd ref="327338598"/><nd ref="327338600"/><nd ref="327338604"/>
    <nd ref="327338607"/><nd ref="327338610"/><nd ref="327338584"/>
    <tag k="building" v="yes"/>
    <tag k="created_by" v="Potlatch 0.10f"/>
    <tag k="name" v="Sir Colin Campbell Building"/>
  </way>
  <way id="29712712" visible="true" timestamp="2010-12-03T19:19:17Z" user="LivingWithDragons"
  uid="7630" version="3" changeset="6530063">
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    <nd ref="327338590"/><nd ref="329127305"/><nd ref="1018817544"/>
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    <nd ref="1018817817"/><nd ref="327338596"/><nd ref="327338598"/>
    <nd ref="1018817871"/><nd ref="1018817843"/><nd ref="327338600"/>
    <nd ref="327338604"/><nd ref="1018817685"/><nd ref="1018817765"/>
    <nd ref="1018817459"/><nd ref="1018817901"/><nd ref="1018817509"/>
    <nd ref="327338607"/><nd ref="327338610"/><nd ref="1018817481"/>
    <nd ref="1018817520"/><nd ref="327338584"/>
    <tag k="building" v="yes"/>
    <tag k="name" v="Sir Colin Campbell Building"/>
  </way>
</osm>
```
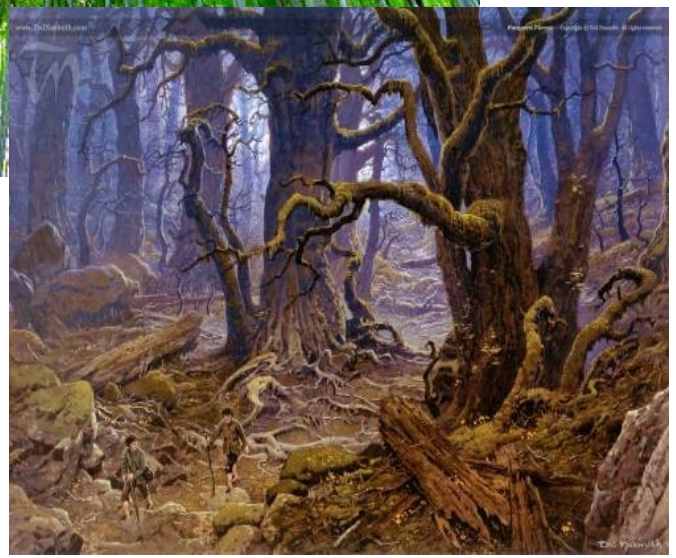
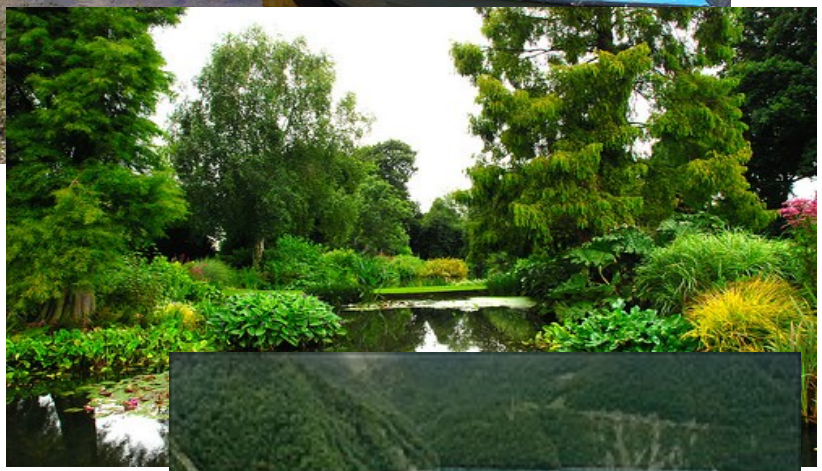

http://www.openstreetmap.org/browse/way/29712712

Is it really that difficult to map?



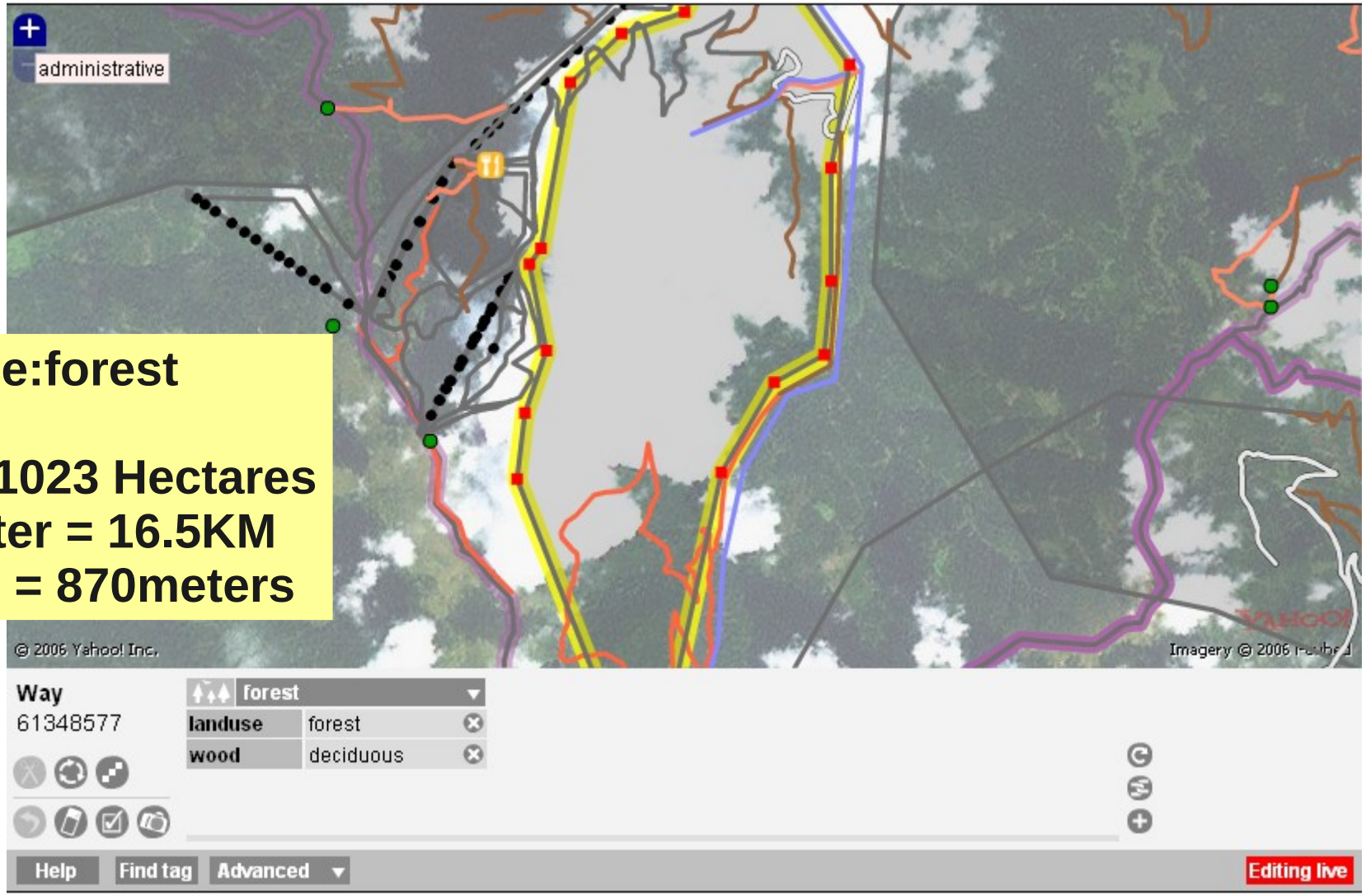
There is no STANDARD, TEMPLATE Forest



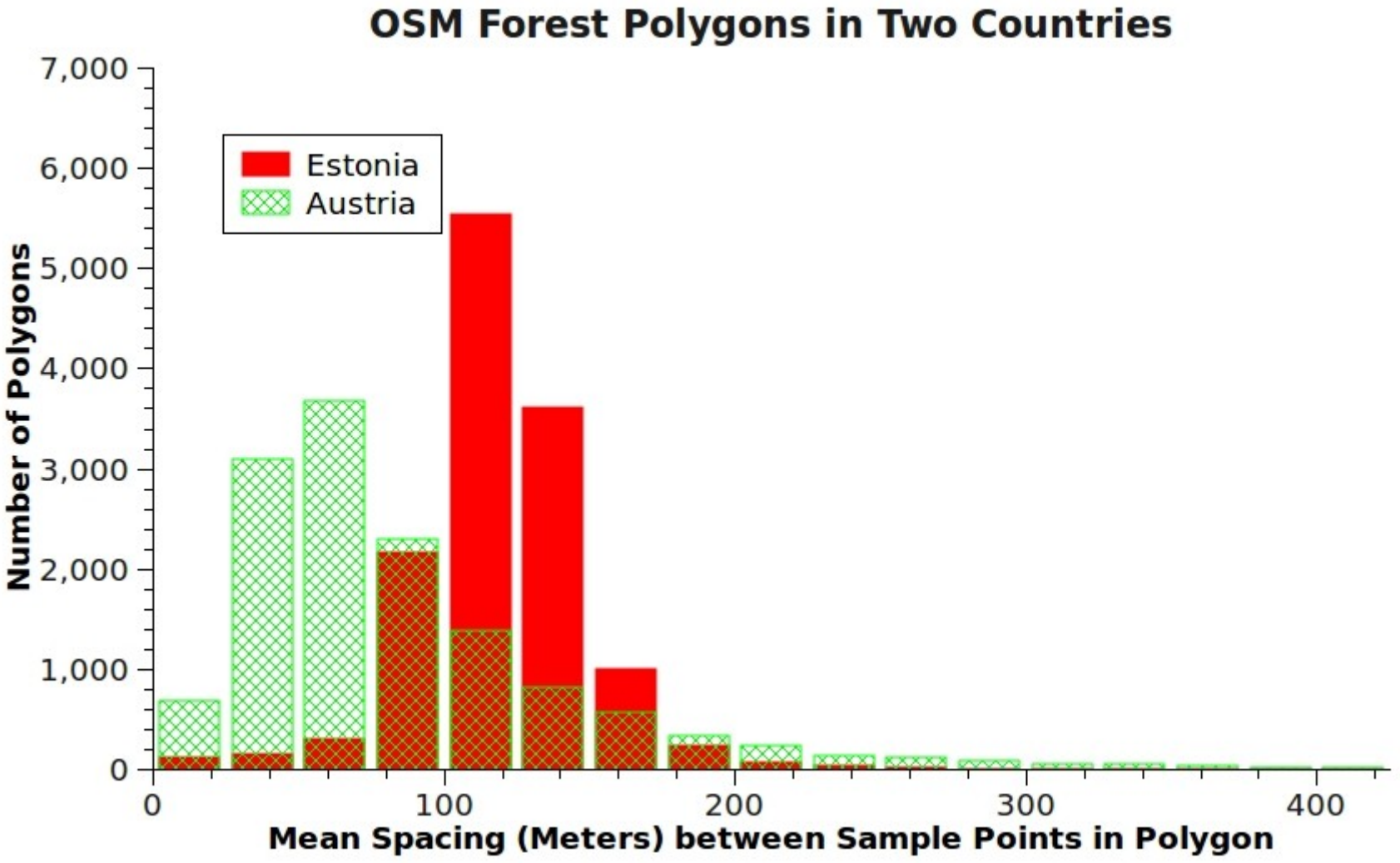
There is no STANDARD TEMPLATE for Water Bodies

Austria (OSM-ID =61848677) – largest polygon in the 0-25 node range

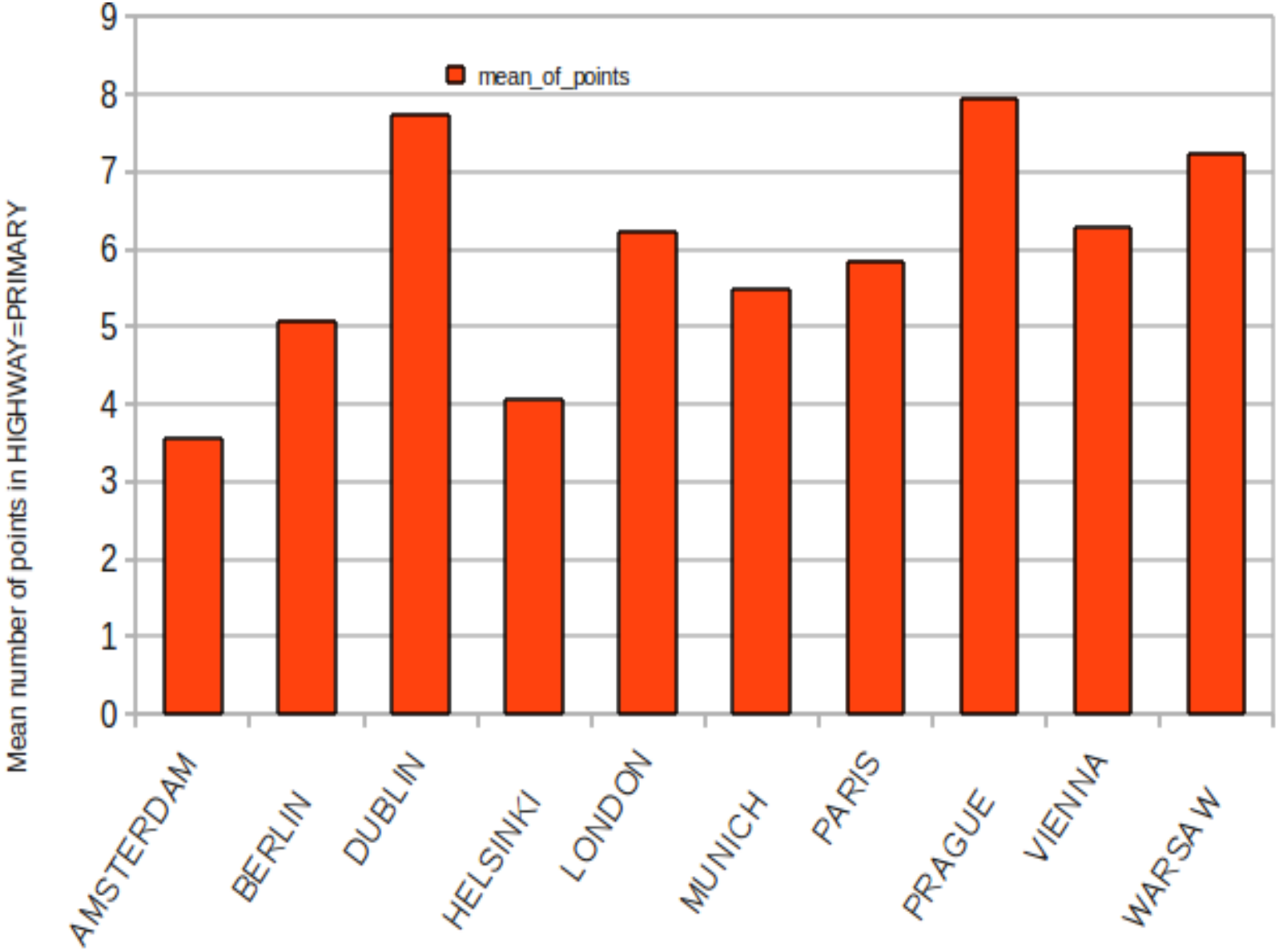
Landuse:forest
N = 19
Area = 1023 Hectares
Perimeter = 16.5KM
Mean D = 870meters



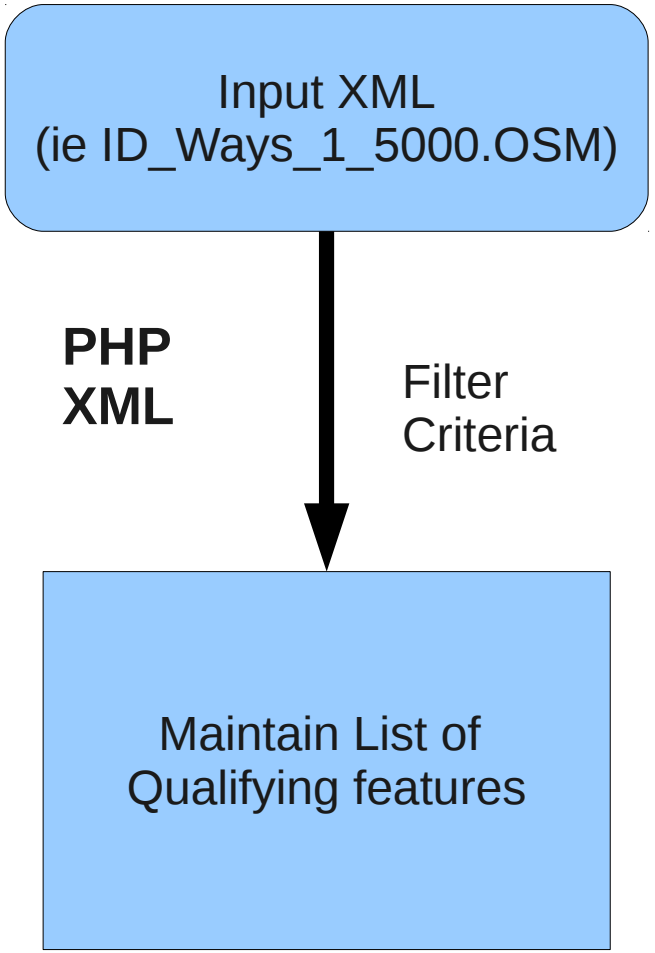
Bulk Uploads – scale can vary between locations for same features



Primary Highways – 10 Cities



For analysis we use a PHP/Python implementation to process the XML



For each polygon/line in this list

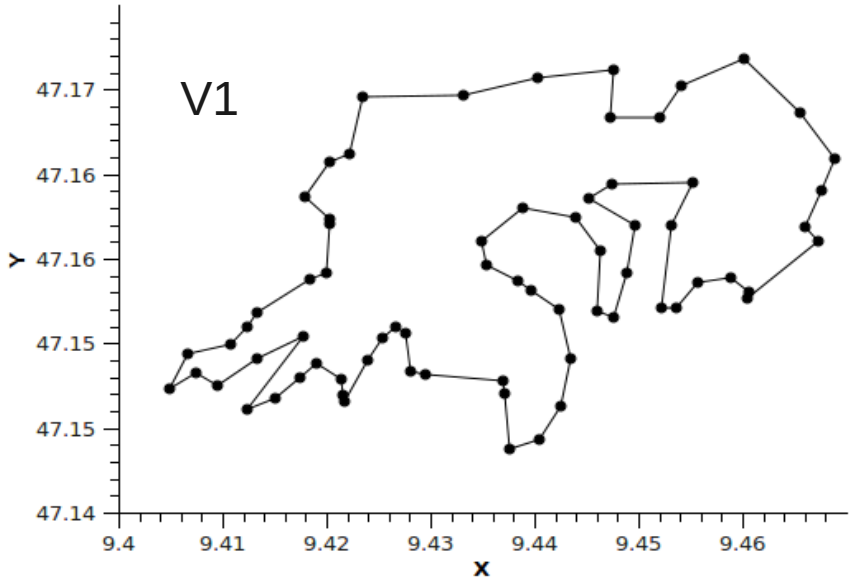
- Download history from OSM
- Store geometry in PostGIS
- Calculate spatial properties
- Analyse Tags
- Analyse Users
- Generate graphical outputs
- Generate SHP, GPX, KML

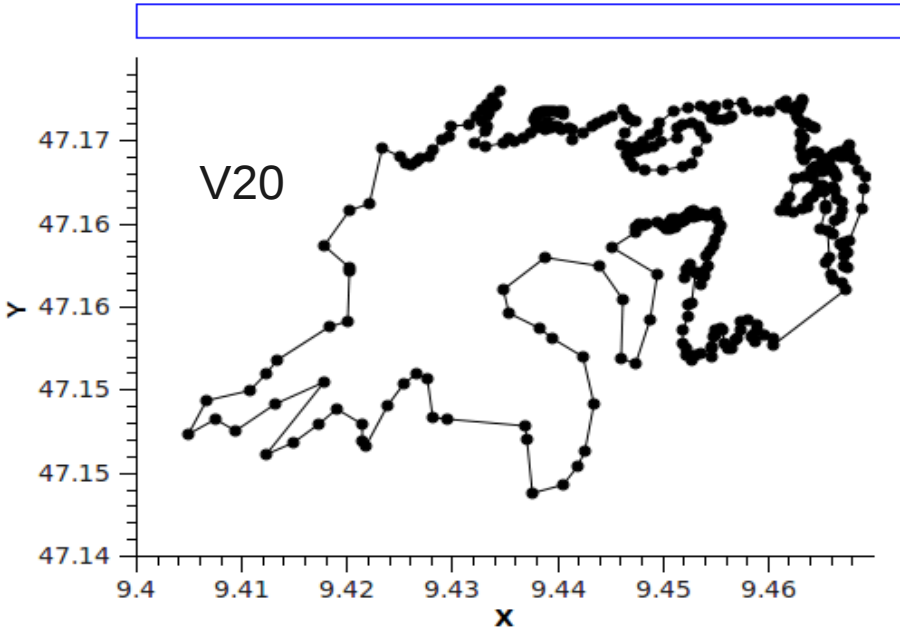
This approach, while not a direct DB import, provides better flexibility

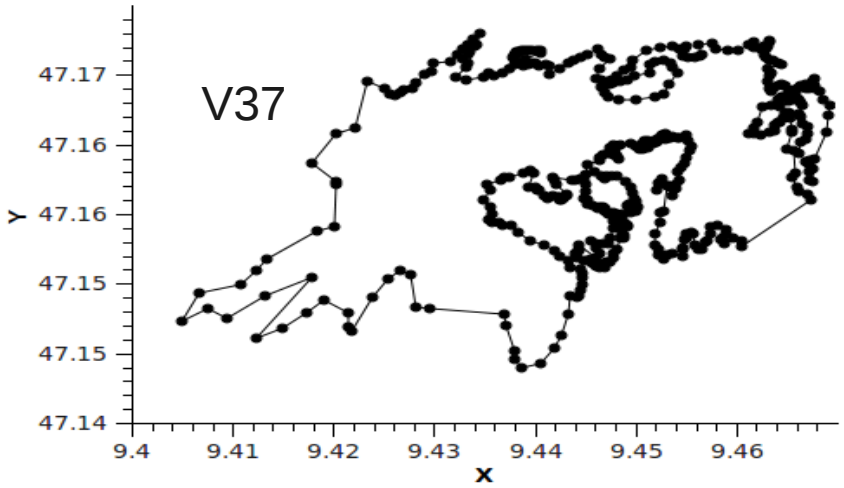
- **CHARACTERISTICS**
- Area, perimeter, area-overlaps
- Tags per version
- Unique users
- Nodes added, deleted
- Spacing between nodes in feature
- Shape similiarity between versions

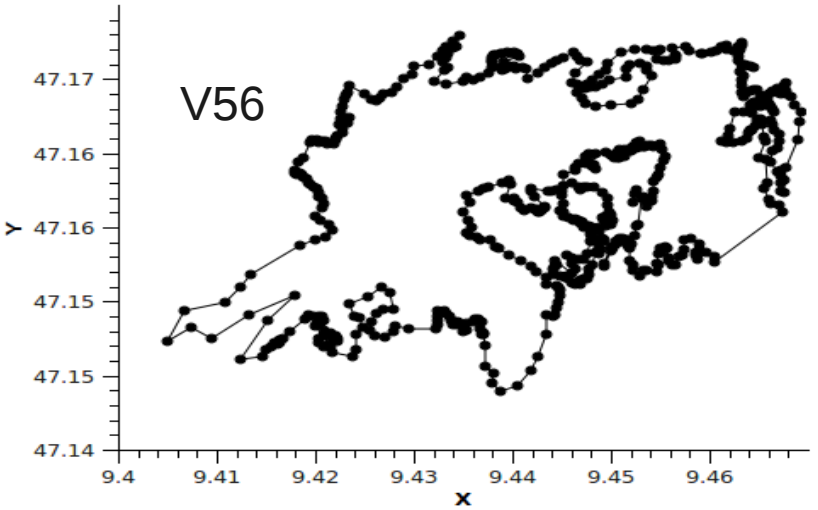
- Easy update of analysis
- Flexibility
- “Quicker” processing than import and maintaining a PostGIS DB for OSM Planet or countries

OSM shapes should *evolve* over time

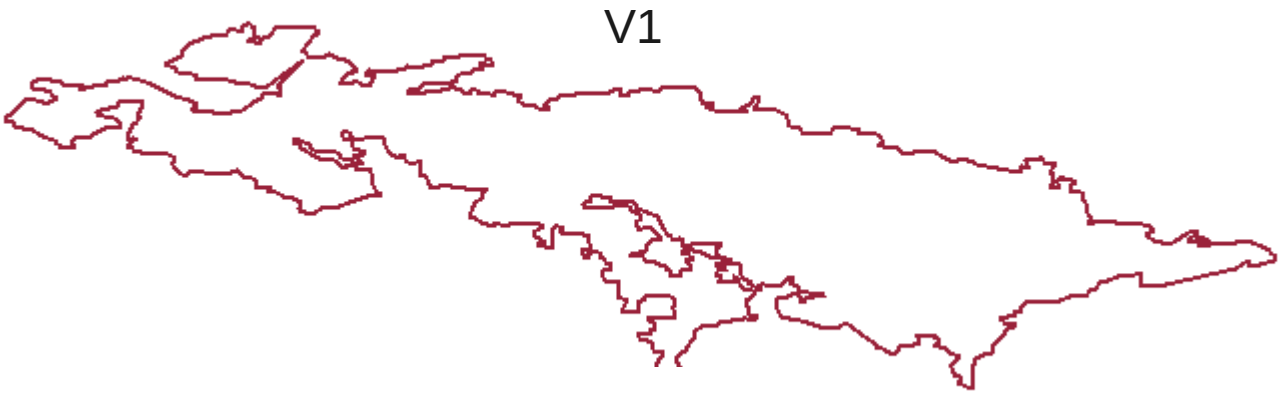


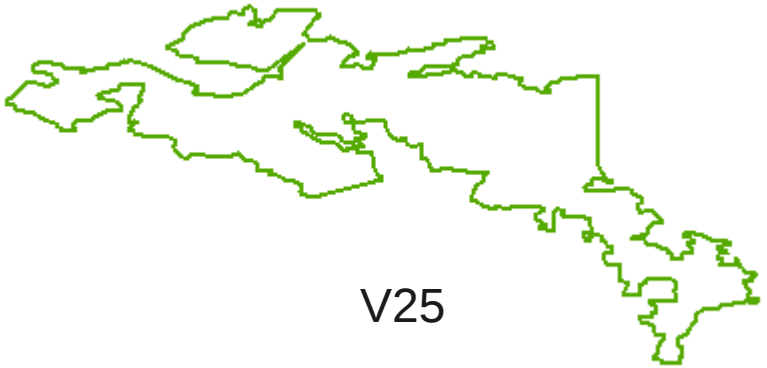






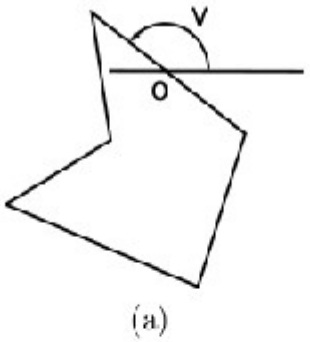
Polygon shape respresentation can change dramatically over versions



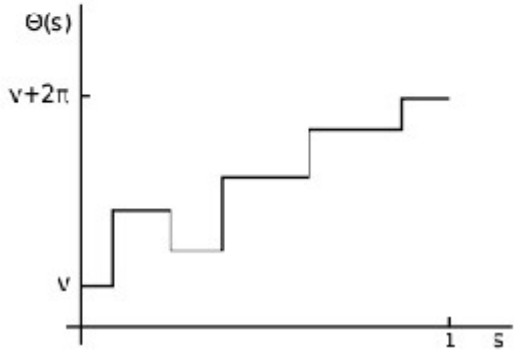


Poland - 25527488

Using shape similarity measures from Pattern Recognition we compared OSM Lakes and OSI Lakes



(a)



$$\delta_p(A,B) = \|\Theta_A - \Theta_B\|_p = \left(\int_0^1 |\Theta_A(s) - \Theta_B(s)|^p ds\right)^{\frac{1}{p}}$$

$$d_p(A,B) = \left(\min_{\theta \in R, t \in [0,1]} \int_0^1 |\Theta_A(s+t) - \Theta_B(s) + \theta|^p ds\right)^{\frac{1}{p}} \quad (2)$$

$$nd_p(A,B) = \frac{1}{1 + d_p(A,B)}$$

Represent each polygon as a Shape Turning Function

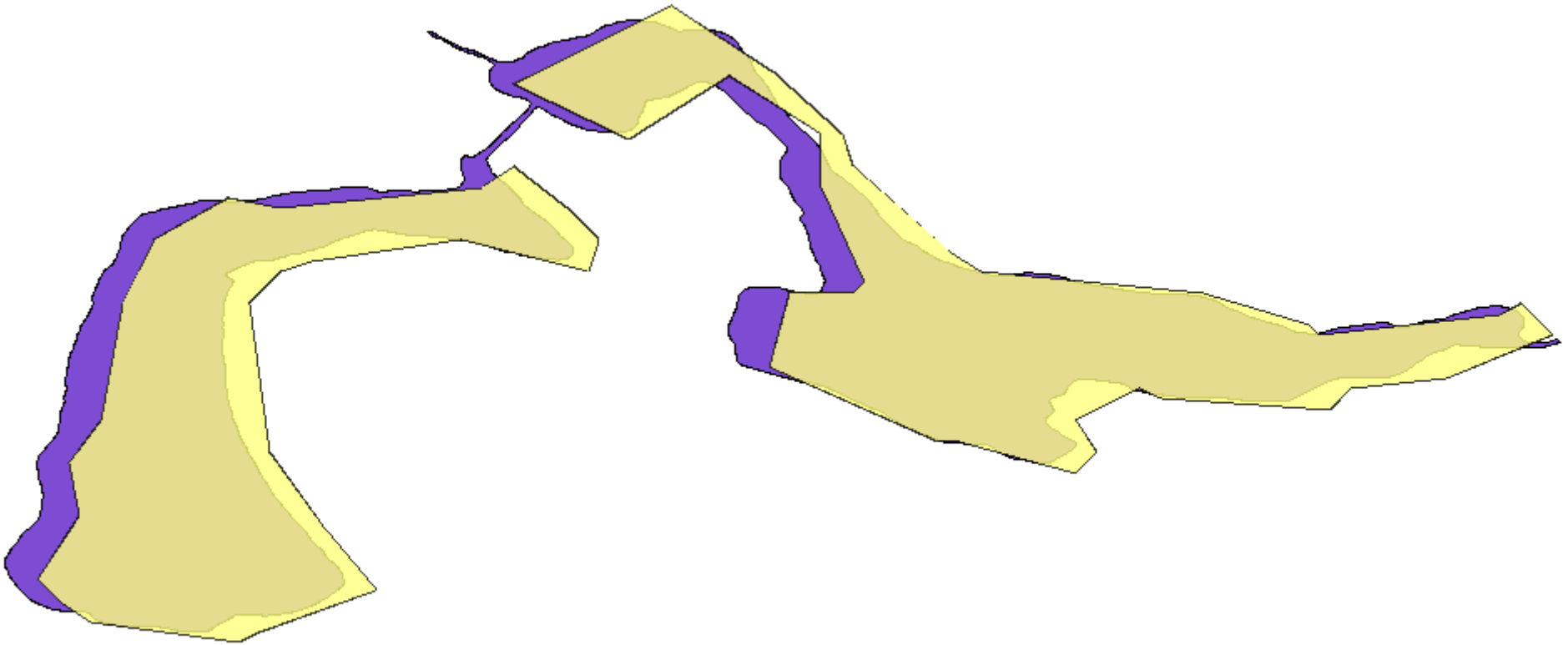
Normalised Dissimilarity Measure

OSI – Ordnance Survey Ireland

High Shape Similarity (0.93)

OSM_ID = 5030097
Lough Ramor, Co. Cavan, Ireland

Very low shape similarity



OSM ID = 23638219 and 23638219

Difficult to access features are an issue in OSM Ireland

Blazej Ciepluch

Dataset	Rail Lines	Disused Rail	Industrial Rail
OSM	1878	59	5
OSI	2092	1449	499

Table 3: Number of Kilometers of Railway lines in both OSM and OSI dataset

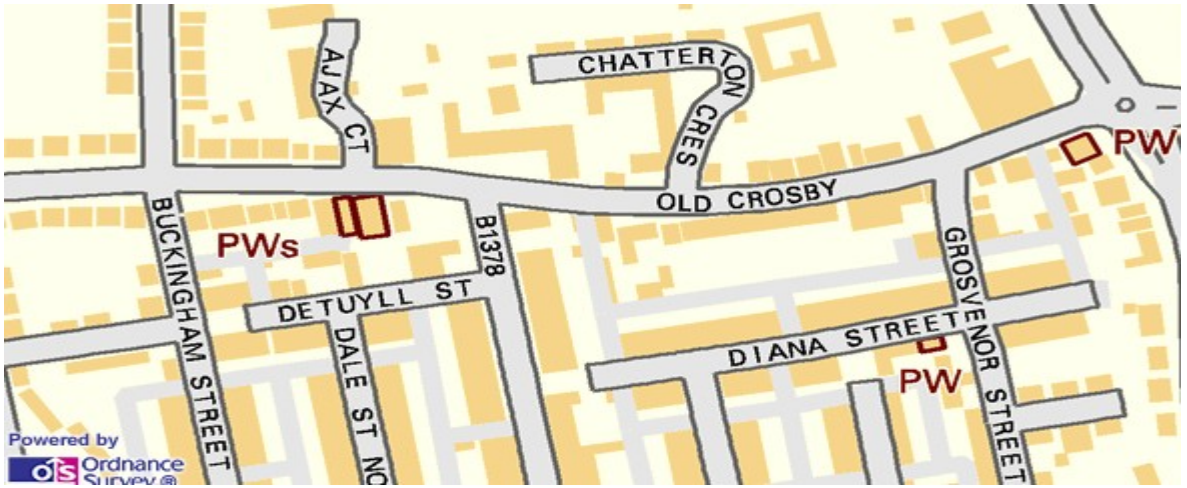
http://www.flickr.com/photos/35110249@N05/4115183250/

Tagging, annotating, and naming spatial objects in OSM

We have carried out analysis of 10,693 “high edit” features in OSM

Region	Amenity	Highway	Landuse	Natural	Waterway
Ireland	3	598	7	19	26
England	63	6992	522	198	548
Scotland	12	939	21	40	42
Wales	3	558	24	12	66
Total	81	9087	574	269	682

- 5 most “popular” features
- Each feature has 20 or more edits
- “Highway” - road network is dominant (84%)
- IE,ENG,SC,WL = (13116,171966,21931,13826)
- Total Versions = 220,839

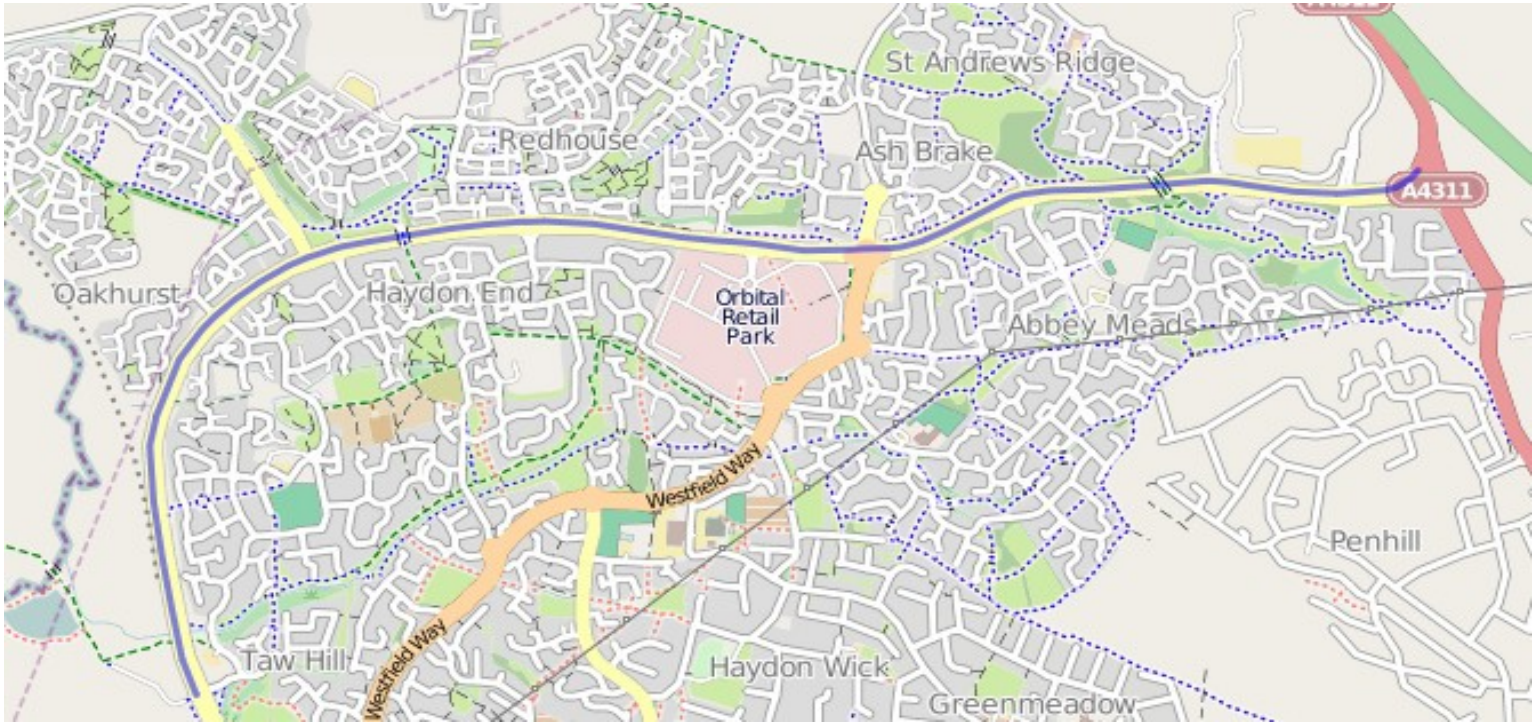


Name Changing Example

v2 name=**Station Road** userid = 11895 06/07/2008
v8 name=**Oswald Road** userid = 11985 06/08/2008
v11 name=**Frodingham Road** userid = 11985 07/08/2008
v13 name=**NULL** userid = 26825 10/10/2008
v23 name=**Ferry Road** userid = 11985 02/06/2009
v25 name=**Old Crosby** userid = 11985 17/06/2009
V26 – 2010-04-12 Current

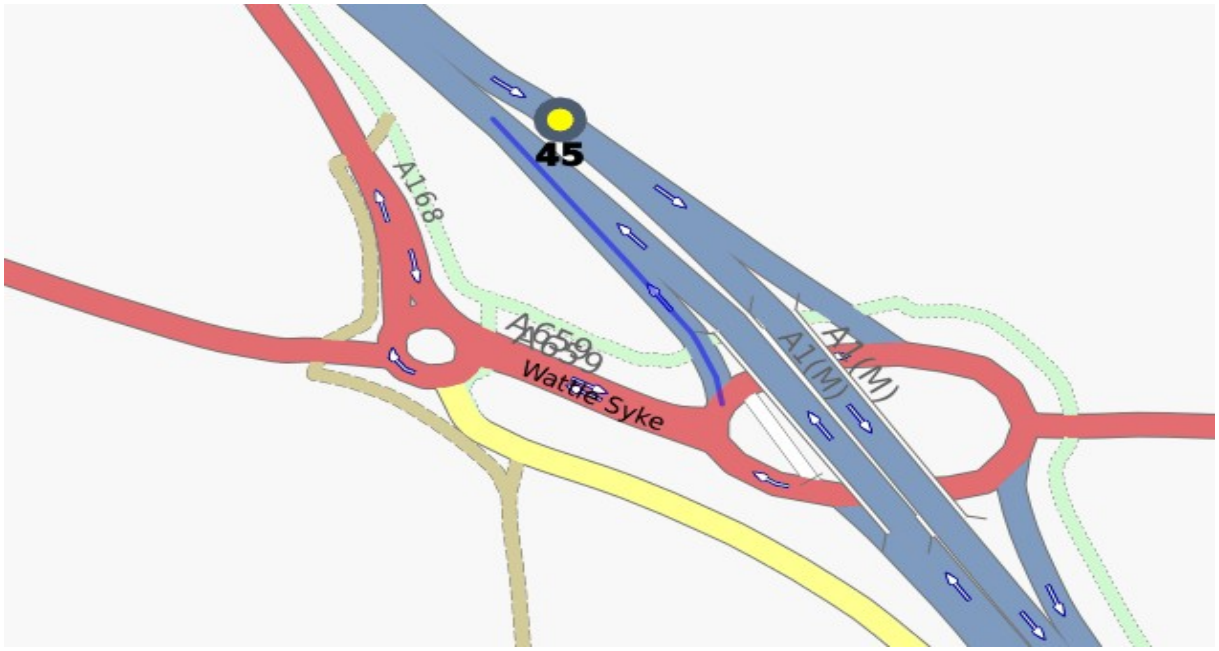
27089250 england

Version	Edit Date	#Users	UserID	KEY: highway
4	21-10-2007 (13:34)	1	17021	secondary; primary
8	21-10-2007 (15:41)	1	17021	secondary;
11	21-10-2007 (18:27)	1	17021	secondary
15	14-03-2008 (18:03)	2	17021	secondary; unclassified
20	14-03-2008 (18:09)	2	17021	unclassified
24	14-03-2008 (18:16)	2	17021	residential
51	26-02-2010 (17:52)	4	231477	tertiary
54 (Final)	03-12-2010 (00:09)	6	17021	tertiary



23659027 england

Version	Edit Date	#Users	UserID	KEY: highway
5	07-04-2008 (22:37)	1	30937	trunk
7	07-04-2008 (22:41)	1	30937	motorway
8	27-04-2008 (11:48)	1	30937	motorway_link
11	24-09-2008 (14:21)	3	8235	trunk_link
12	25-09-2008 (23:12)	3	15578	motorway_link
13	25-09-2008 (23:13)	3	15578	trunk_link
15	12-05-2009 (18:38)	5	124226	motorway_link=construction
16	12-05-2009 (18:50)	5	124226	motorway
17	12-05-2009 (18:57)	5	124226	motorway_link=construction
18	18-07-2009 (12:34)	5	15578	motorway_link
19 (Final)	23-08-2009 (18:15)	6	25753	motorway_link

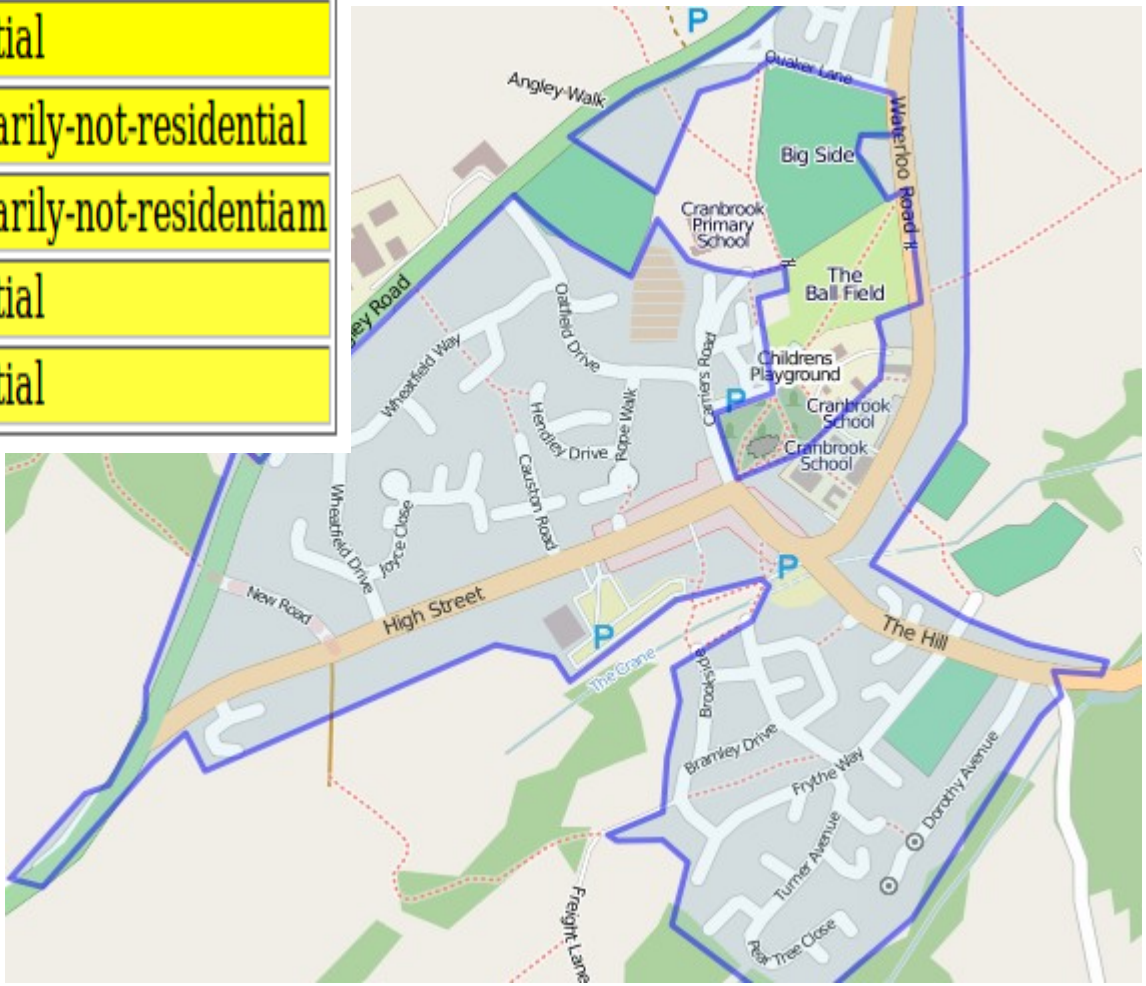


4541817 wales

Version	Edit Date	#Users	UserID	KEY: highway
13	04-12-2007 (09:19)	3	15217	primary
21	20-02-2008 (23:51)	3	15217	primary_link
24	03-10-2008 (14:53)	4	8235	trunk
29	13-10-2008 (13:59)	5	72920	primary
30	13-10-2008 (14:13)	5	8235	trunk
32	15-12-2008 (11:52)	5	15217	primary
37	14-01-2009 (10:00)	5	15217	primary_link
39	20-03-2009 (21:40)	5	15217	primary
42 (Final)	17-02-2010 (10:14)	5	15217	primary

5019736 (Residential?)

Version	Edit Date	#Users	UserID	KEY: landuse
1 (First)	04-08-2007 (10:10)	1	6809	residential
18	23-03-2008 (22:37)	3	7463	temporarily-not-residential
19	23-03-2008 (22:40)	3	7463	temporarily-not-residentiam
20	24-03-2008 (15:40)	3	7463	residential
63 (Final)	22-04-2010 (21:56)	4	7511	residential



4002091 westcliff on sea

Version	Edit Date	#Users	UserID	KEY: natural
1 (First)	16-11-2006 (00:39)	1	4772	coastline
12	15-07-2010 (18:35)	2	74897	marsh
13	22-08-2010 (17:11)	3	31231	wetland
15 (Final)	24-01-2011 (09:27)	4	354566	wetland

22906037 - Glasgow

Version	Edit Date	#Users	UserID	KEY: natural
1 (First)	08-02-2008 (10:16)	1	4772	coastline
7	01-07-2008 (13:09)	3	6494	water
16	18-09-2008 (16:27)	5	35579	riverbank
17	18-09-2008 (16:38)	5	35579	water
23	16-01-2010 (13:35)	6	36667	No natural tag specified
28 (Final)	17-10-2010 (12:51)	0	0	No natural tag specified

Currently – waterway=dock

Austria - 4848350

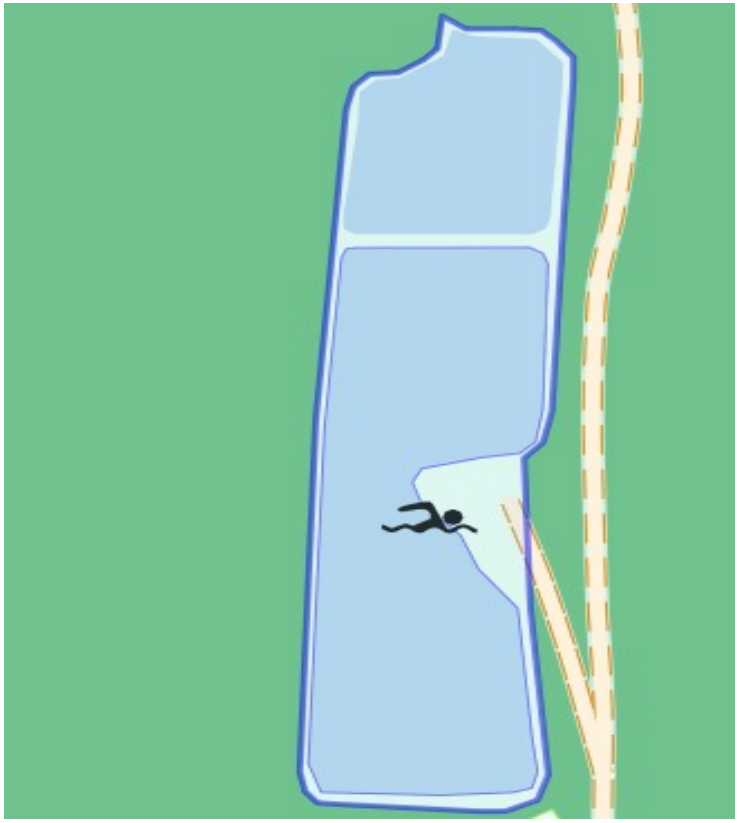
Version	Edit Date	#Users	UserID	KEY: highway
1 (First)	03-07-2007 (07:58)	1	924	unclassified
2	29-11-2007 (12:07)	2	12295	secondary
5	10-05-2008 (17:56)	4	36674	tertiary
7	11-05-2008 (22:00)	4	36674	residential
14	26-05-2010 (09:50)	9	292689	crossing
17	31-05-2010 (18:52)	12	95598	residential
20 (Final)	10-11-2010 (10:11)	14	96069	residential

Changing Landuse - Austria

Version	Edit Date	#Users	UserID	KEY: natural	KEY: landuse
1 (First)	17-10-2007 (02:11)	1	16464	water	No landuse tag specified
4	17-07-2008 (13:49)	3	42253	wood	forest
7	21-07-2008 (15:51)	3	42253	No natural tag specified	forest
8	11-02-2009 (07:50)	4	16330	No natural tag specified	farmland
9	11-02-2009 (07:51)	4	16330	No natural tag specified	meadow
10 (Final)	18-08-2009 (07:05)	4	42253	No natural tag specified	meadow

Strange Rendering...

Meadow is the only tag...



http://www.openstreetmap.org/?way=9682620

Mixed/Incorrect Landuse

Version	Edit Date	#Users	UserID	KEY: natural	KEY: landuse
1 (First)	20-10-2007 (09:46)	1	508	No natural tag specified	No landuse tag specified
2	04-11-2007 (20:08)	2	1611	wood	cemetary
4	23-01-2008 (20:22)	4	5735	wood	cemetery
7	22-01-2009 (00:37)	5	85302	No natural tag specified	cemetery
20 (Final)	31-10-2010 (13:33)	7	164908	No natural tag specified	cemetery

In some instances “tag wars” can occur over mundane features

Version	User	HIGHWAY	Edit ON
1	7070	Trunk	15/11/2009
4	20510	Construction	16/11/2009
5	7070	Trunk	17/11/2009
7	19889	Construction	17/11/2009
10	7070	Trunk	17/11/2009
11	19889	Construction	17/11/2009
12	7070	Trunk	19/11/2009
	…….	…..	…..
78	206986	Construction	19/12/209
79	7070	Trunk	20/12/2009
80	206986	Construction	20/12/2009
81	210596	Trunk	20/12/2009
88	145231	Construction	16/2/2011

http://www.openstreetmap.org/?way=44401788

Semantics of Metadata in OSM – is the flexibility a bad thing?

Version	Date	User ID	Tags	Action
1	09/08/08	24748	landuse=forest	add
			souce=Landsat	add
2	18/08/08	8732	Natural=wood	add
32	16/01/09	24748	Natural=wood	delete
53	19/05/09	100946	area=yes	add
71	01/08/09	53563	wood=mixed	add
82	08/04/10			

OSM_ID = 26164873

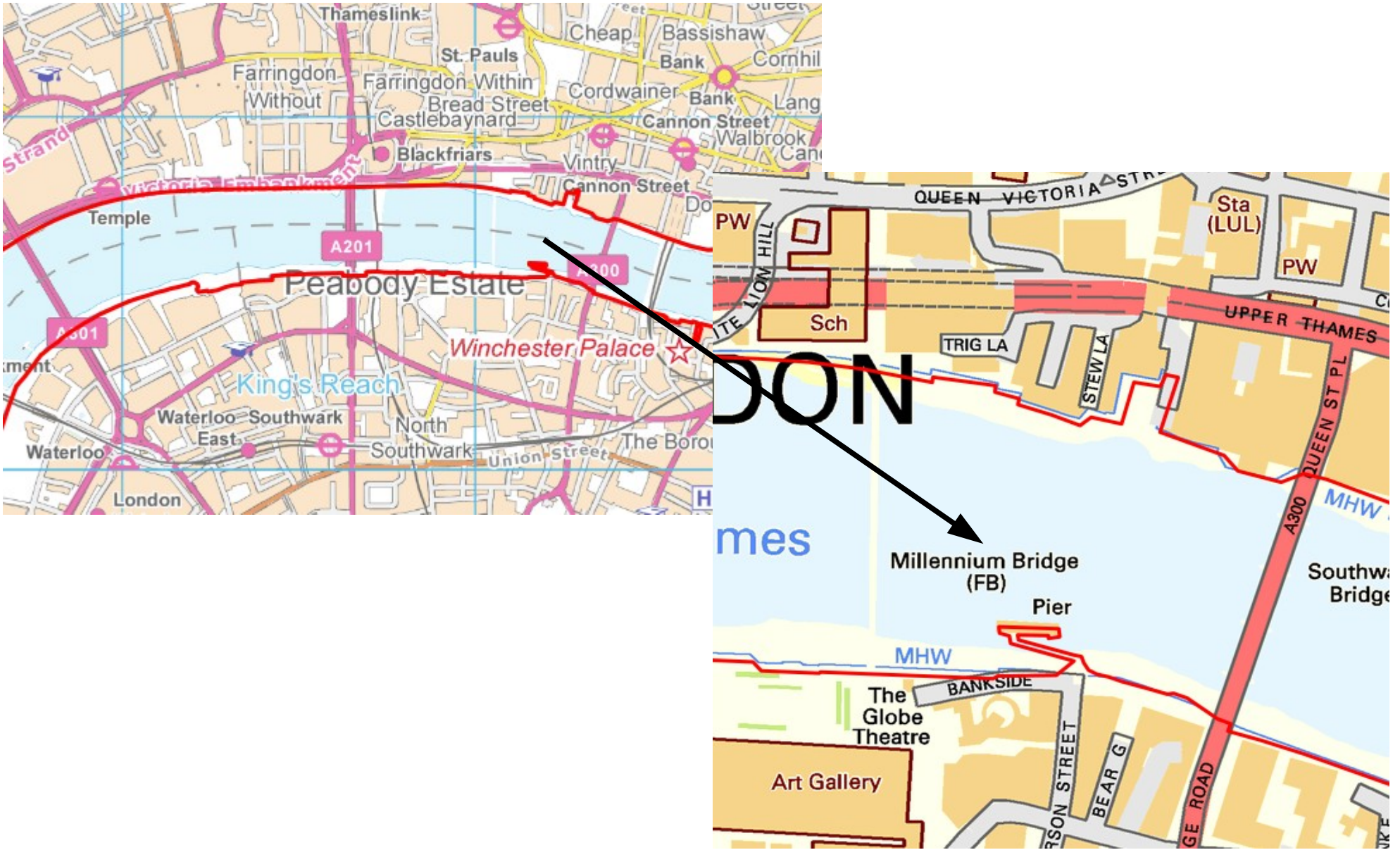
Semantic ambiguity of tags must be a consideration in the future (Contador et al, 2010)

Because users relate their terminology straight into the information names or concepts without considering the class origins, land cover is fast becoming a "monster". (Comber et al, 2005)

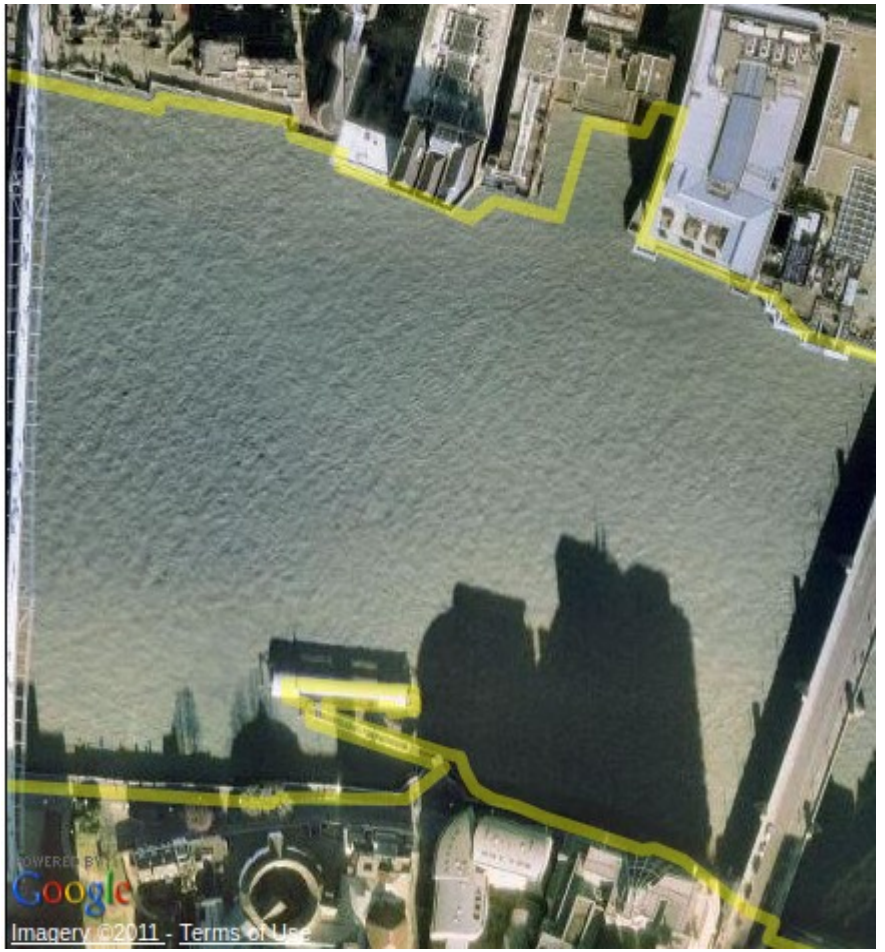
Examples of Editing and Evolution of Features in OSM

Including Animations..

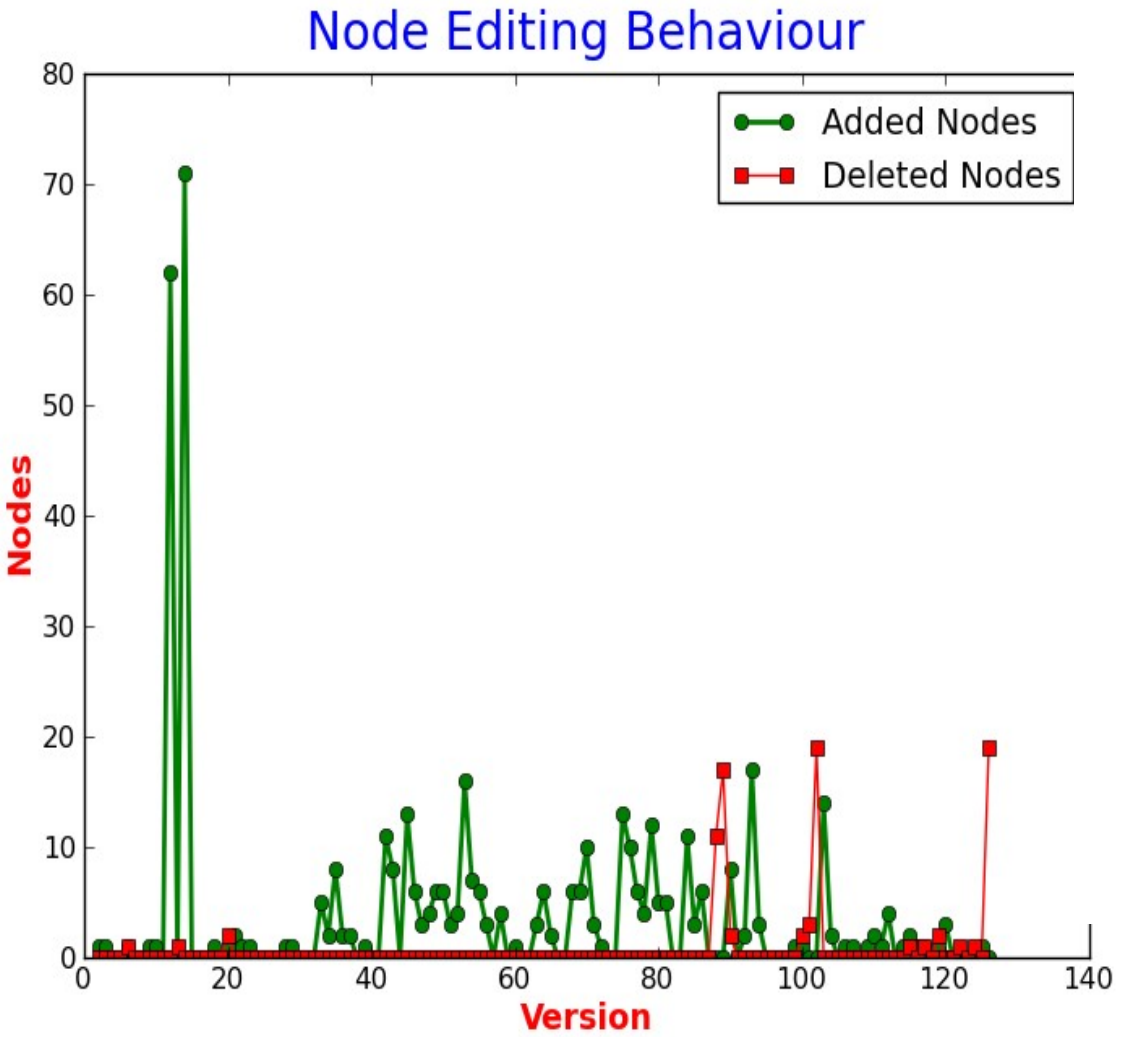
The Thames – editing is concentrated around “The City”

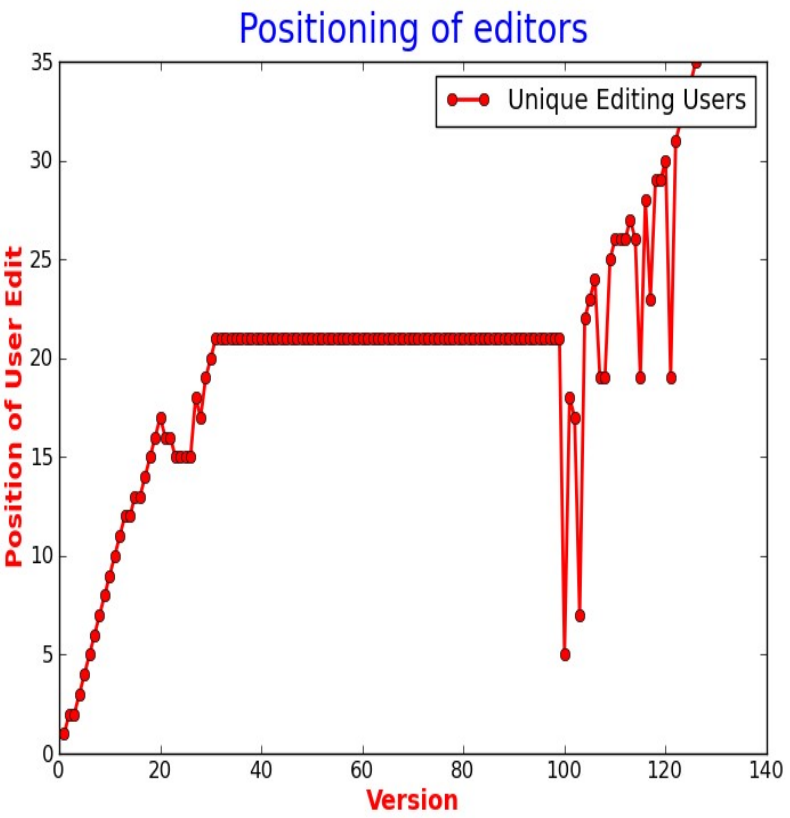


The River Thames – Central London

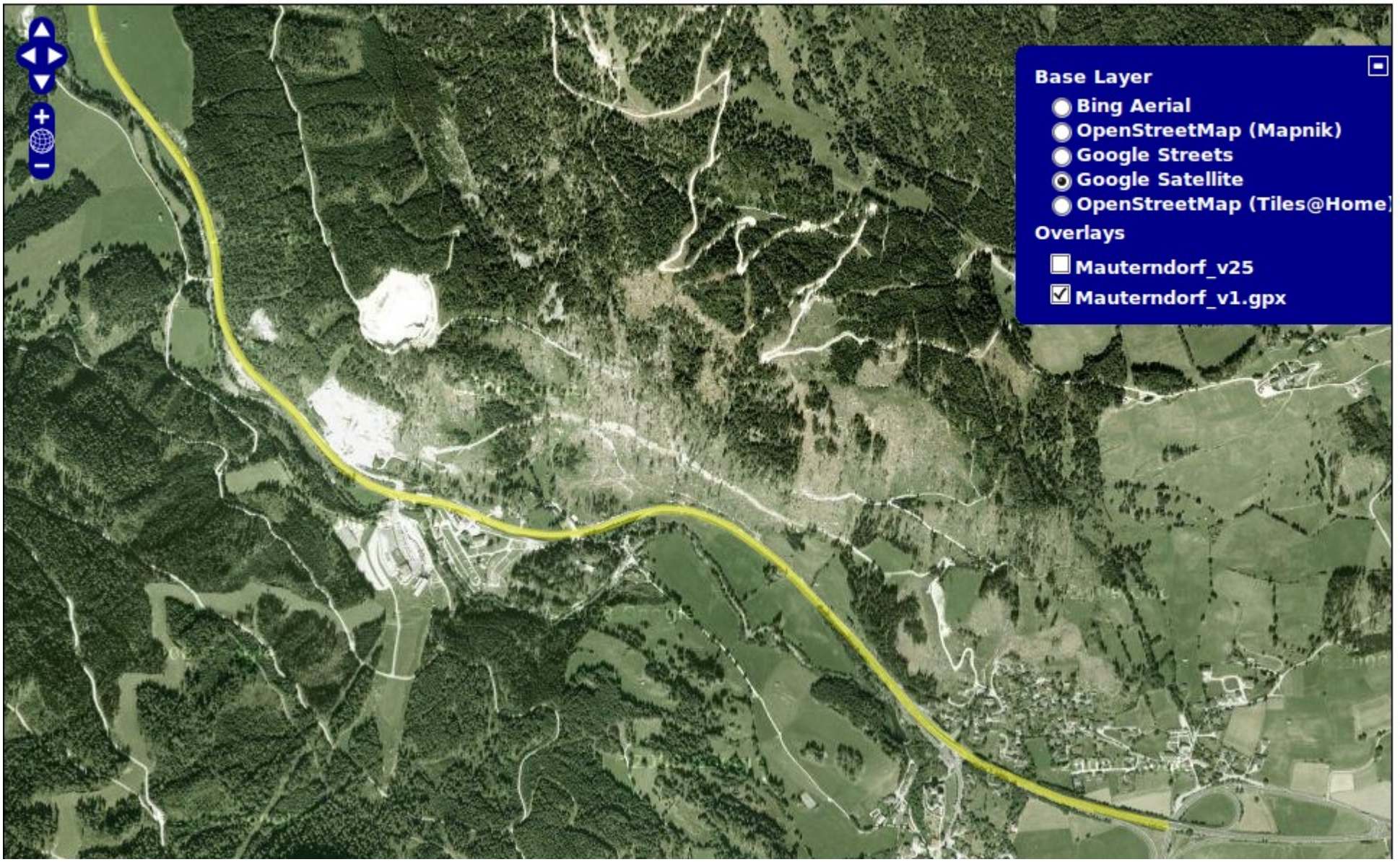


Thames 8125890



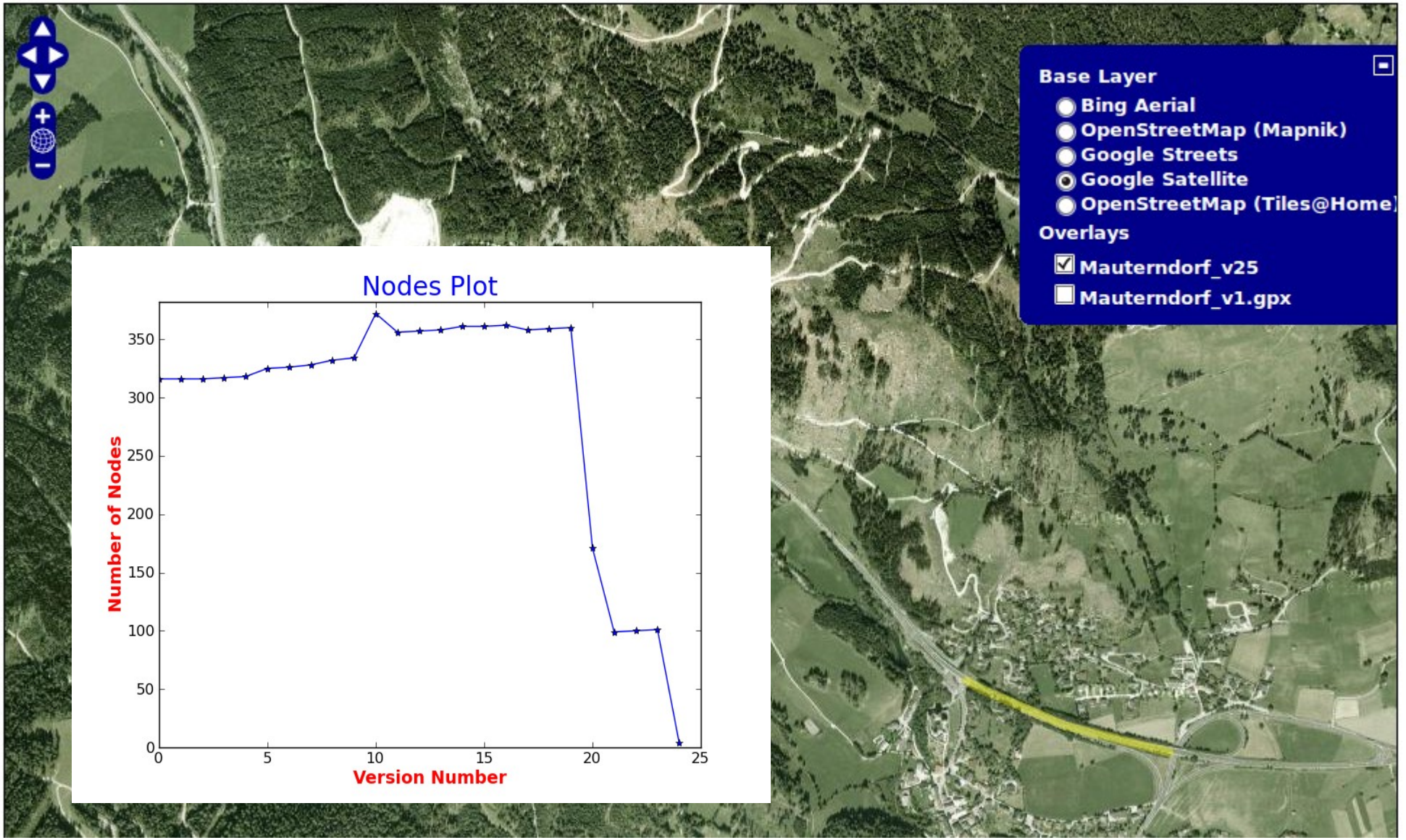


Austria: Primary B99 Mauterndorf (OSM-ID = 4818273)



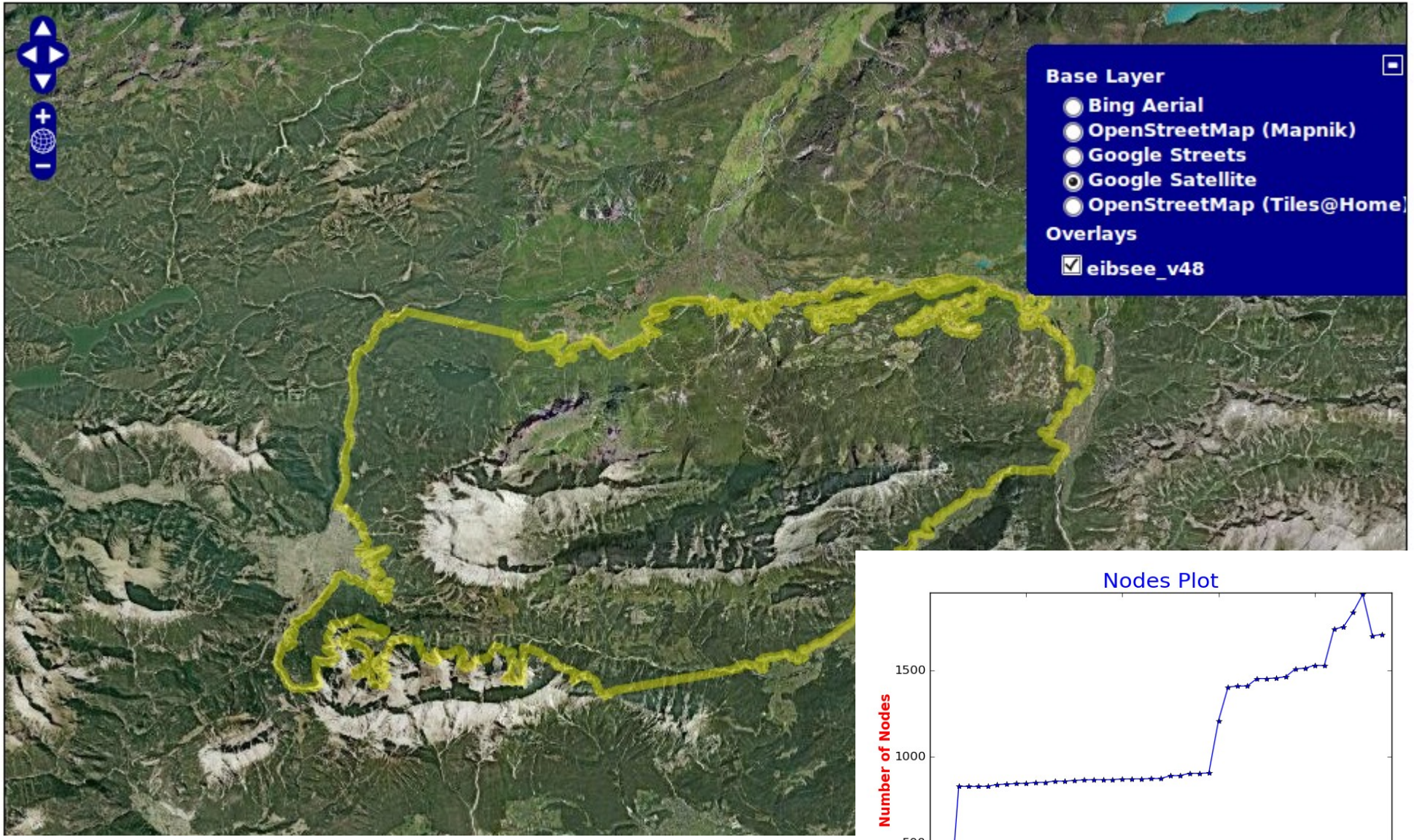
"2007-06-27 00:07:28", 316 nodes

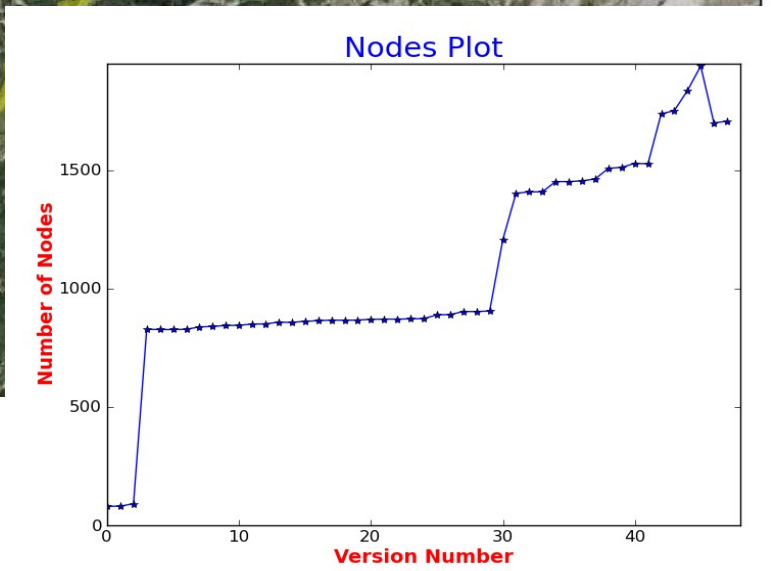
Austria: Primary B99 Mauterndorf (OSM-ID = 4818273)



"2010-09-25 22:39:15", 4 nodes, 14 contributors

Austria: Forest near Eibsee (OSM-ID = 35838913)





"2009-06-12 07:50:56" – version 1
Overall 16 contributors

Strange “straight” sections....

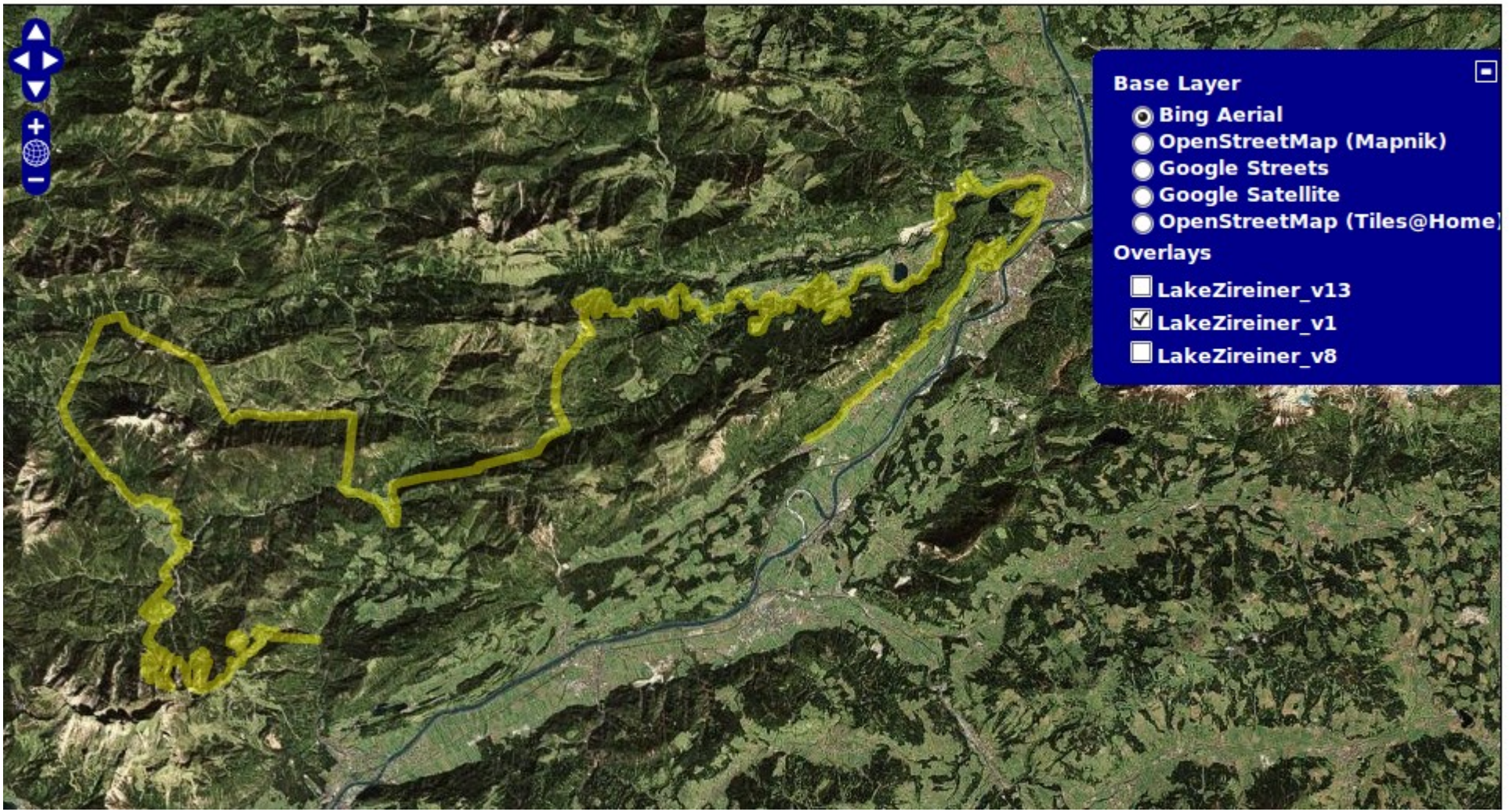
Austria: Forest near Eibsee (OSM-ID = 35838913)

Version 48 - "2011-03-17 06:46:20"

This has characteristics of poor aerial imagery tracing...

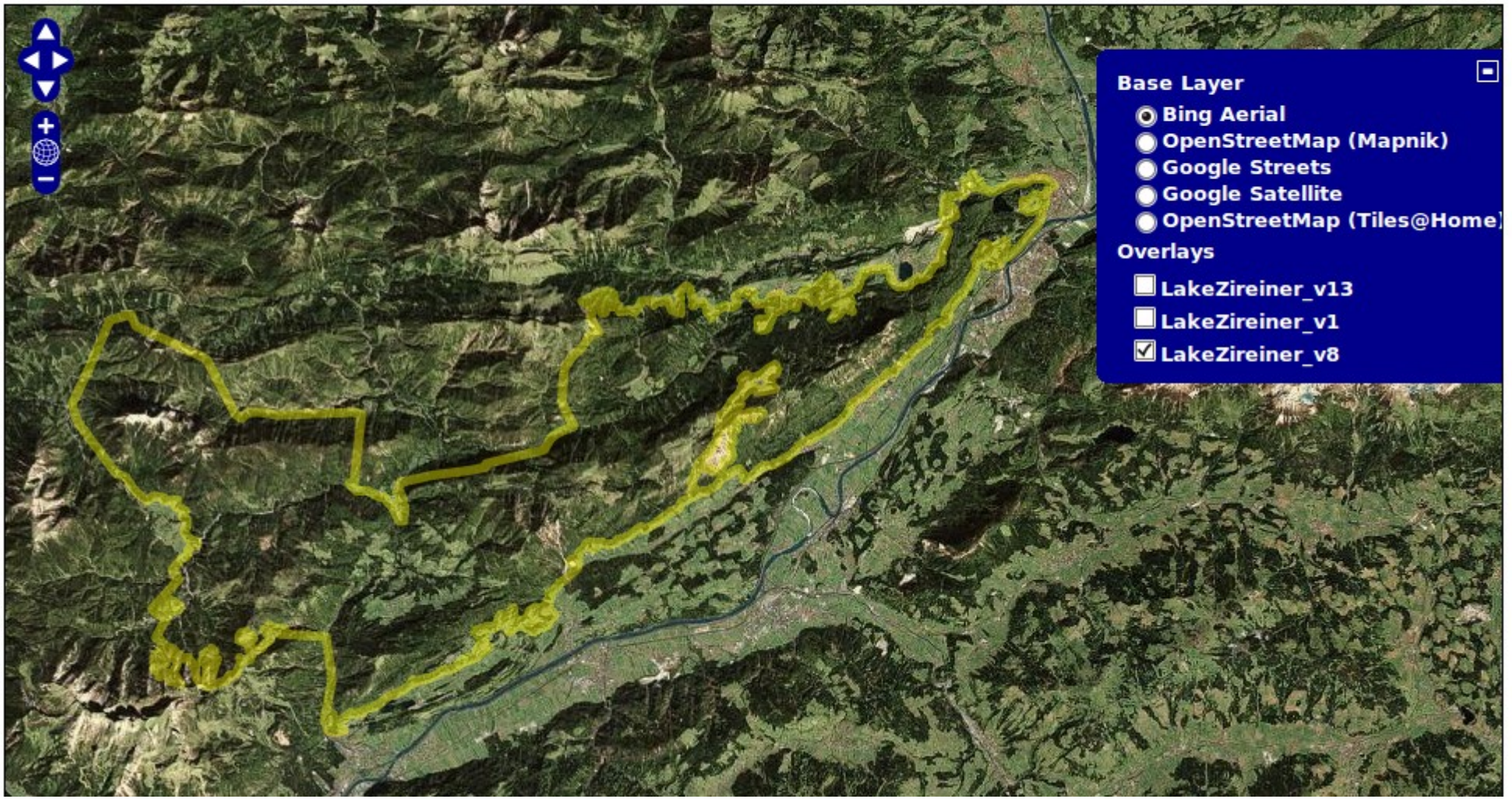
Austria: Forest near Eibsee (OSM-ID = 35838913)

Austria: Forest near Lake Zireiner (OSM-ID = 92407476)



"2010-12-30 11:47:13", LINESTRING – Version 1 (landuse=forest)

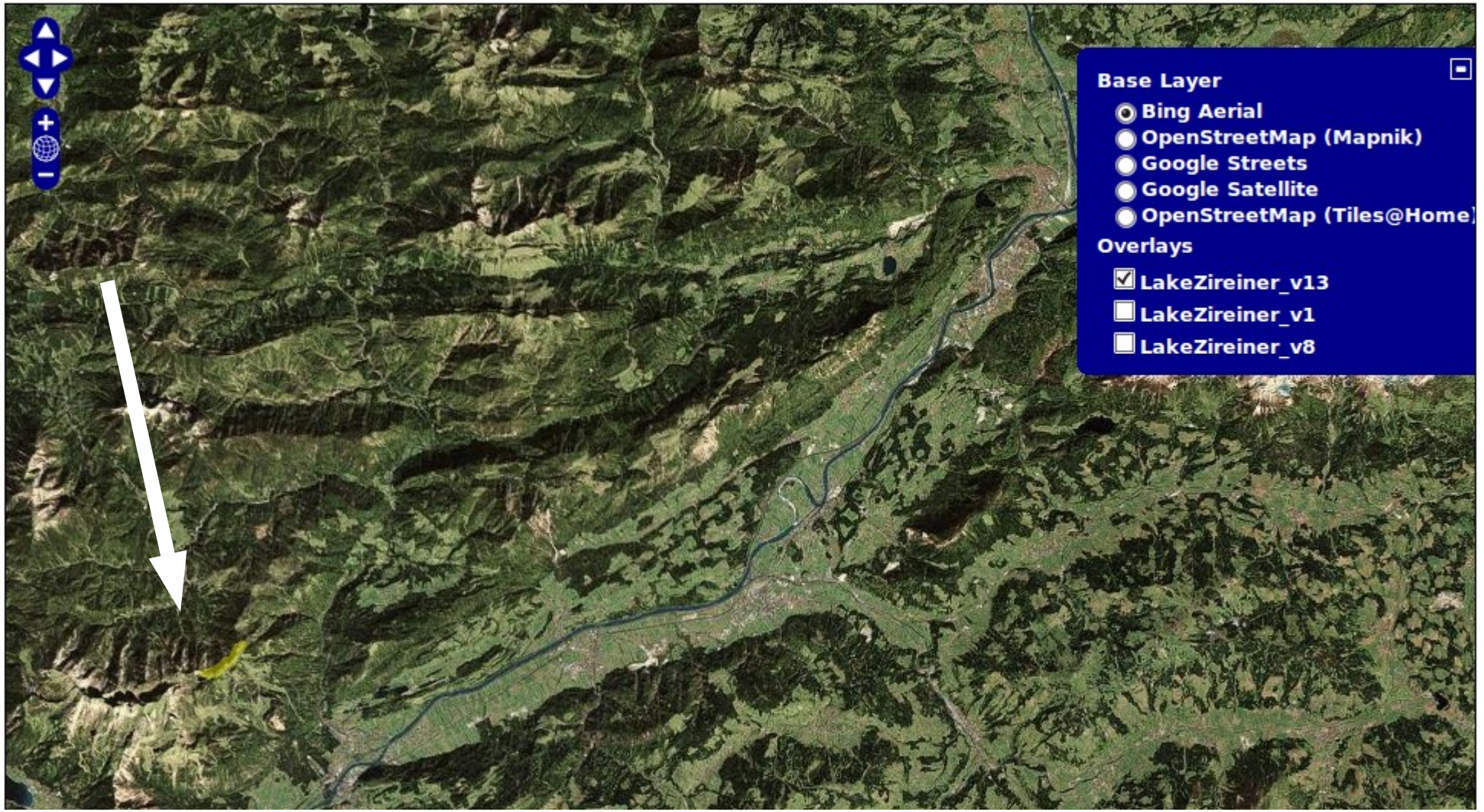
Austria: Forest near Lake Zireiner (OSM-ID = 92407476)



"2011-03-03 13:38:03" Version 8, 3 Contributors, POLYGON

Complete deletion of work..

Austria: Forest near Lake Zireiner (OSM-ID = 92407476)



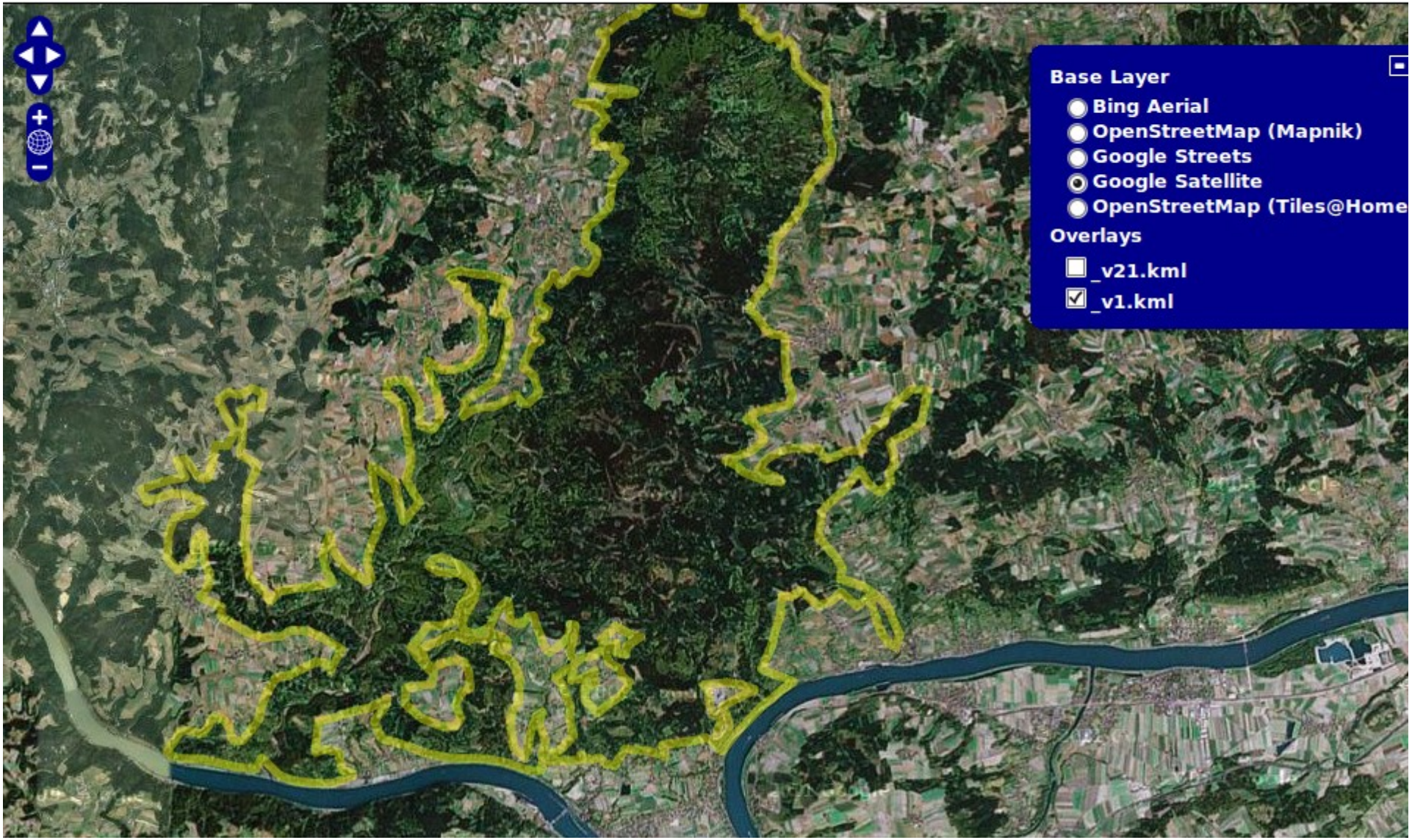
"2011-03-19 20:04:59", 5 Contributors, LINESTRING

Forest polygon is now Polyline

Austria: Forest near Lake Zireiner (OSM-ID = 92407476)

Austria: Landuse Polygon (OSM-ID = 13864876)

KML layer overlayed



MARBACH AN DER DONAU
Version 1 ("2007-11-23 20:59:12")

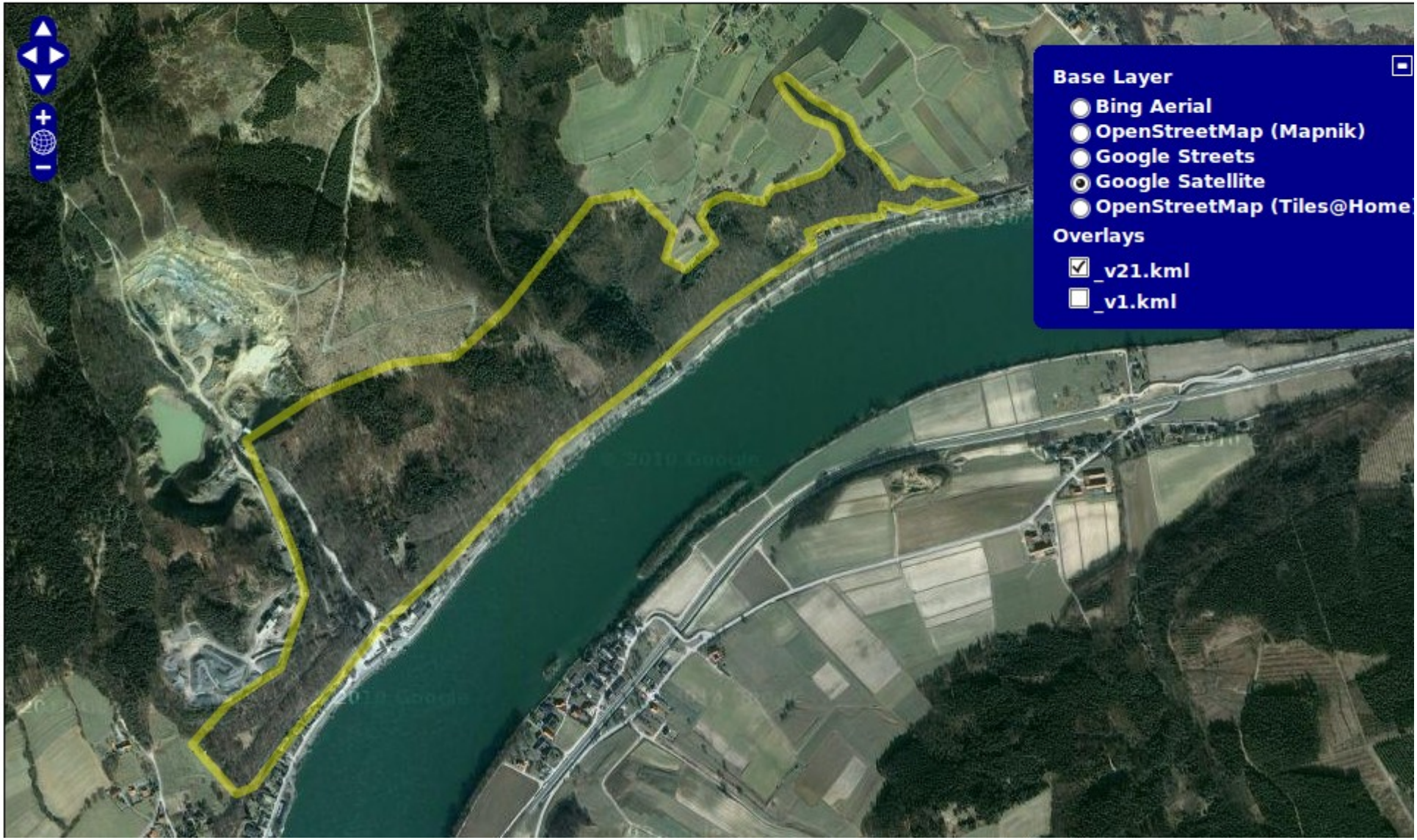
Austria: Landuse Polygon (OSM-ID = 13864876)

KML layer overlayed

MARBACH AN DER DONAU
Version 21 ("2011-03-09 21:08:11" – 9 Unique Users, 1 Tag (landuse = forest))

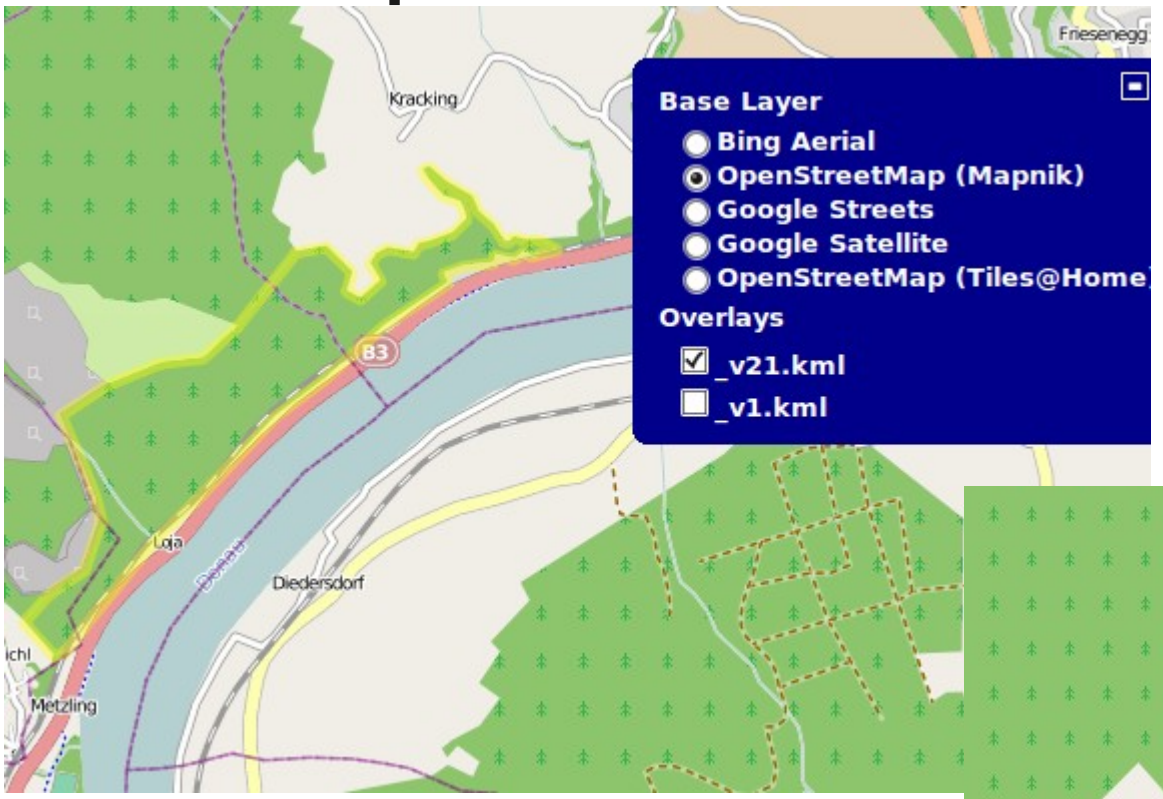
Austria: Landuse Polygon (OSM-ID = 13864876)

KML layer overlayed



MARBACH AN DER DONAU
Version 21 ("2011-03-09 21:08:11" – 9 Unique Users, 1 Tag (landuse = forest))

Further editing of 13864876 has taken place – breaking the polygon

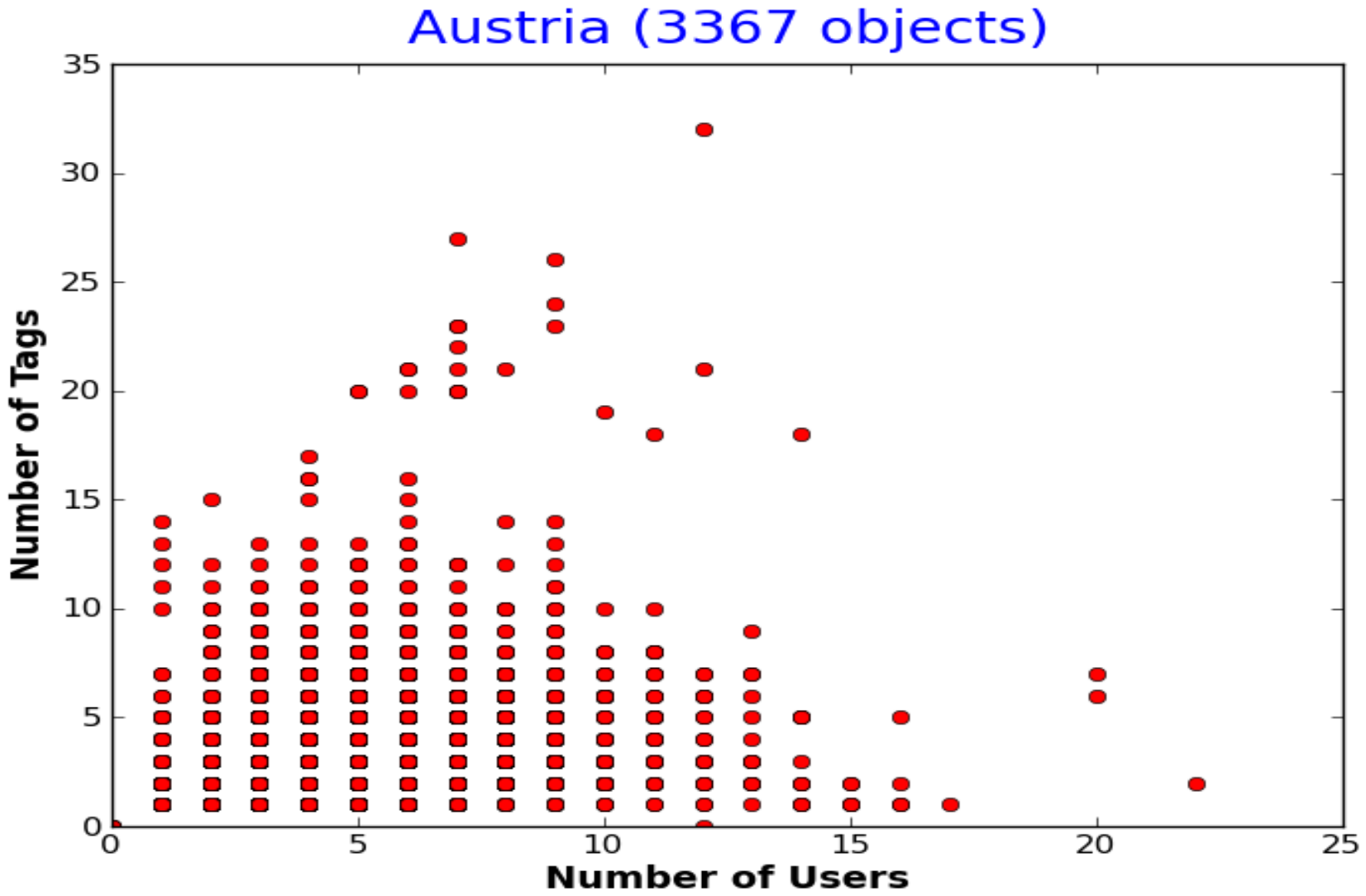


Wed, 06 Apr 2011
20:16:38
Tags deleted (0 tags)
Version 23

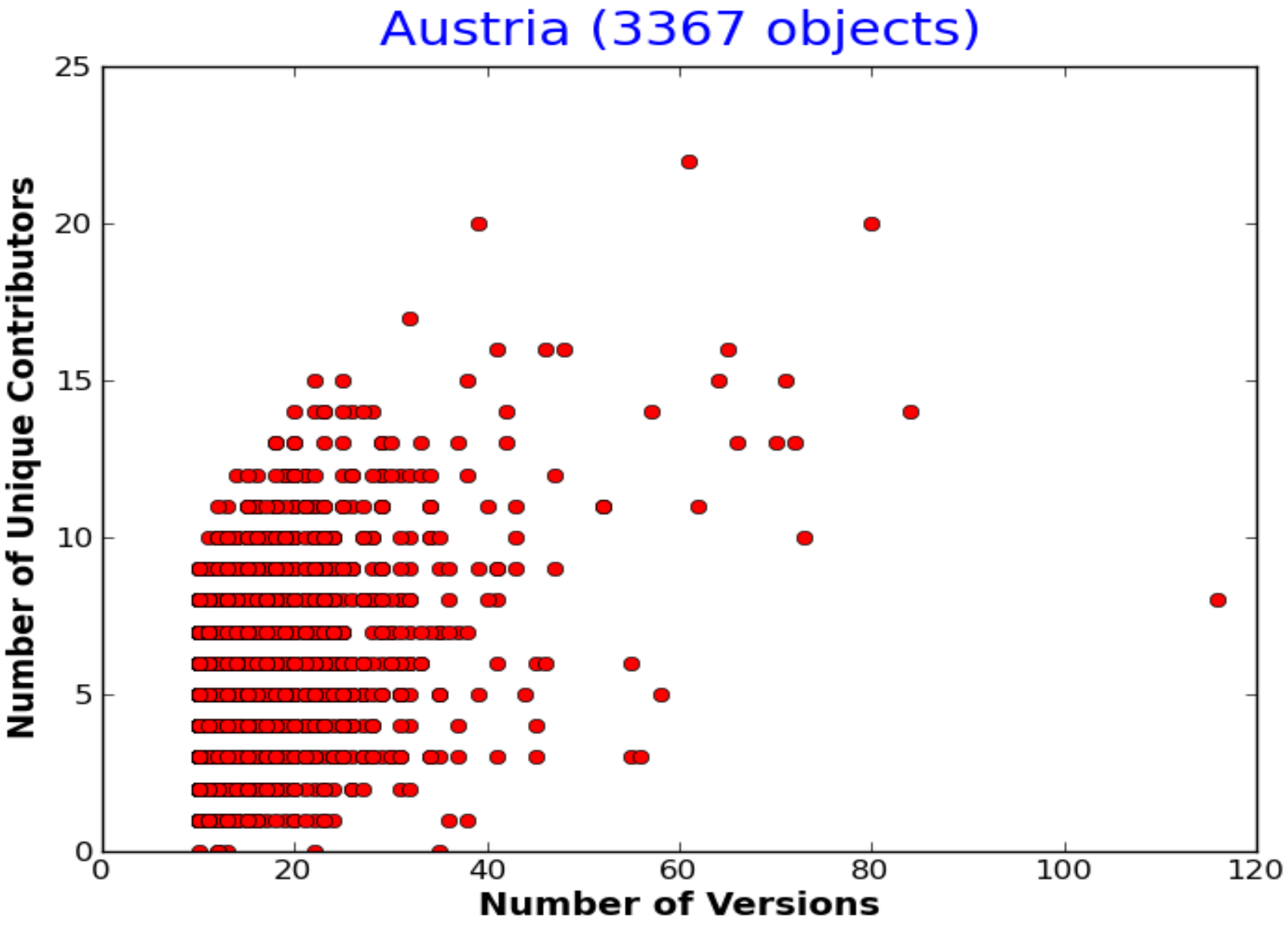
This is an invalid polygon

It cannot be cartographically rendered
Without any tags.

Increasing contributors is not strongly correlated with *better* tagging



The relationship between increased contributors & versions is not clear



Looking at the contributors

Some interesting statistics are available regarding user edits

- "*The data that are contributed to VGI projects do not comply with standard spatial data quality assurance procedures, and the contributors operate without central coordination and strict data collection frameworks*" (**Haklay et al, 2010**)
- "*beyond 15 contributors per square kilometre, the positional accuracy becomes very good below 6 metres*"
- "*the first 5 contributors to an area seem to provide the biggest contribution in terms of positional accuracy improvement*".

Overall summary of our study of OpenStreetMap Ireland and UK

- Total of **220,779** edits
- England – **171,907**
- Scotland – **21,931**
- Wales – **13,825**
- Ireland – **13,116**
- There are **3084** unique contributors
- **25 users** edited in all 4 countries
- **56 users** edited all 5 chosen feature types
- Earliest contributions begin in **May 2007**

User contributions follow an approximation of a power-law distribution

- **SCOT** – 2 users > 1000 edits (1581,8230)
- **WAL** – 3 users > 1000 edits (1256,1403,2102)
- **ENG** – 28 users > 1000 edits (1071 – 6086)
- **IRE** - 3 users > 1000 (1168,1213,1488)

Edits	#Contributors
< 5	1442
5 – 10	368
10 – 20	329
20 – 50	372
50 – 100	202
100 – 200	150
200 – 500	126
500 – 1000	59
1000-2000	17
2000-5000	17
> 5000	2

Contributor effort is similar between UK & Ireland and Austria

Edits	#Contributors
1	441
< 5	838
5 – 10	200
10 – 100	358
100 – 500	75
500 – 1000	9
1000 – 2000	3
2000 – 5000	2

AUSTRIA (1926 unique editors)

Edits	#Contributors
< 5	1442
5 – 10	368
10 – 20	329
20 – 50	372
50 – 100	202
100 – 200	150
200 – 500	126
500 – 1000	59
1000-2000	17
2000-5000	17
> 5000	2

UK & Irl (3084 unique contributors)

One time “test the water” contributors are significant

- Contributors who performed **ONE EDIT**
- **Ireland** (30% - from 355)
- **England** (27% from 2505)
- **Scotland** (25% from 379)
- **Wales** (28% from 316)
- **Austria** (22% from 1926)

Contributions are mostly restricted to very low volume edits

- Contributors who performed **10 or Less EDITS**
- **Ireland** (66% - from 355)
- **England** (58% from 2505)
- **Scotland** (61% from 379)
- **Wales** (68% from 316)
- **Austria** (74% from 1926)

Consecutive Edits (UK and Ireland, Austria)

Consecutive Versions	Total	(Same User)
Invalid,Invalid	18,979 (9%)	15,816
Valid,Valid	188,165 (90%)	160,064
Invalid,Valid	1,202 (< 1%)	790
Valid,Invalid	1,275 (< 1%)	948

Table 8: The validity status of consecutive versions of the same features

Consecutive Versions	Total	Same User	
Invalid, Invalid	2045 (5%)	1201	147 users (20 > 20 occurrences)
Valid, Valid	42,845 (93%)	24621	
Invalid, Valid	330 (< 1%)	193	
Valid, Invalid	145 (< 1%)	100	58 different users

Austria – bottom table

Consecutive Edits (UK and Ireland, Austria)

Node Edit Action	Total	(Same User)
Nodes Unchanged	39,172 (18%)	32,002
Nodes Deleted	12,600 (6%)	8,066
Nodes Added	157,851 (76%)	137,551

Table 9: Summary of the number of consecutive versions where nodes were added, deleted, or left unchanged.

Node Edit Action	Total	Same User
Nodes Unchanged	18540 (41%)	9784
Nodes Deleted	7562 (17%)	4307
Nodes Added	19267 (42%)	12024

Analysis of the time between consecutive edits to objects

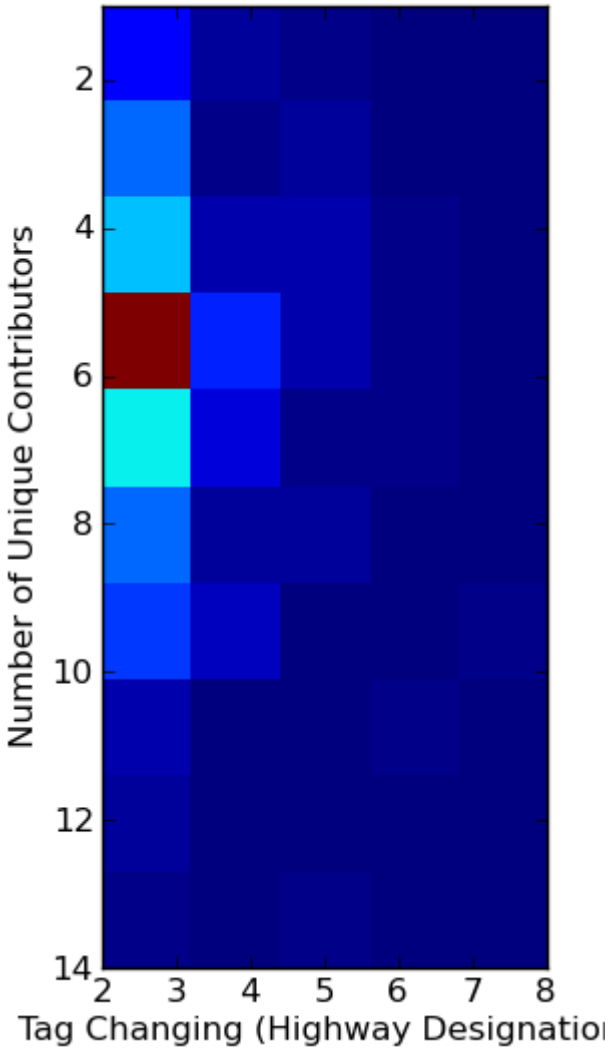
Time Between Versions	Austria (%)	UK and Ireland (%)
<= 5 minutes	3.48	2.94
5 mins to 30 mins	7.03	8.26
30 mins to 1 hour	2.01	1.83
1 hour to 2 hours	13.42	9.30
2 hours to 12 hours	36.00	23.64
12 hours to 24 hours	10.76	8.67
24 hours to 1 week	3.05	2.63
1 week to month	22.83	41.25
> 1 month	1.43	1.48

Austria (3367 Objects – 45,369 consecutive versions)
UK + Ireland (10693 Objects – 206,843 consecutive versions)

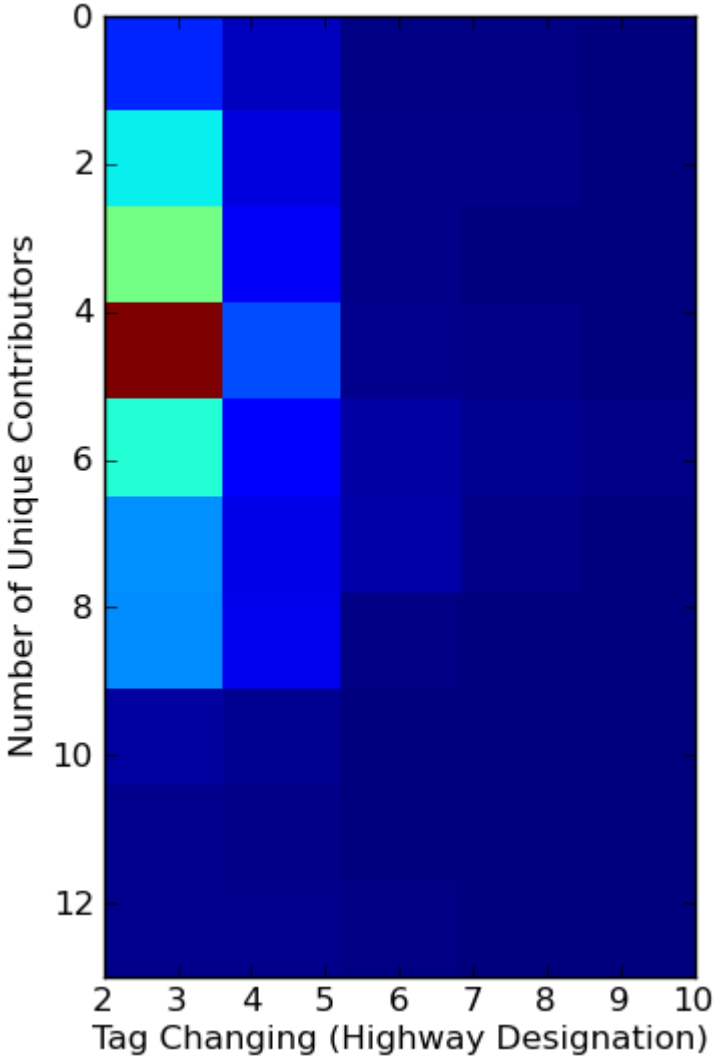
User behaviour analysis? Length of editing sessions . . . return to edit (delay... loss of interest)

Tag “flip flopping” - highways

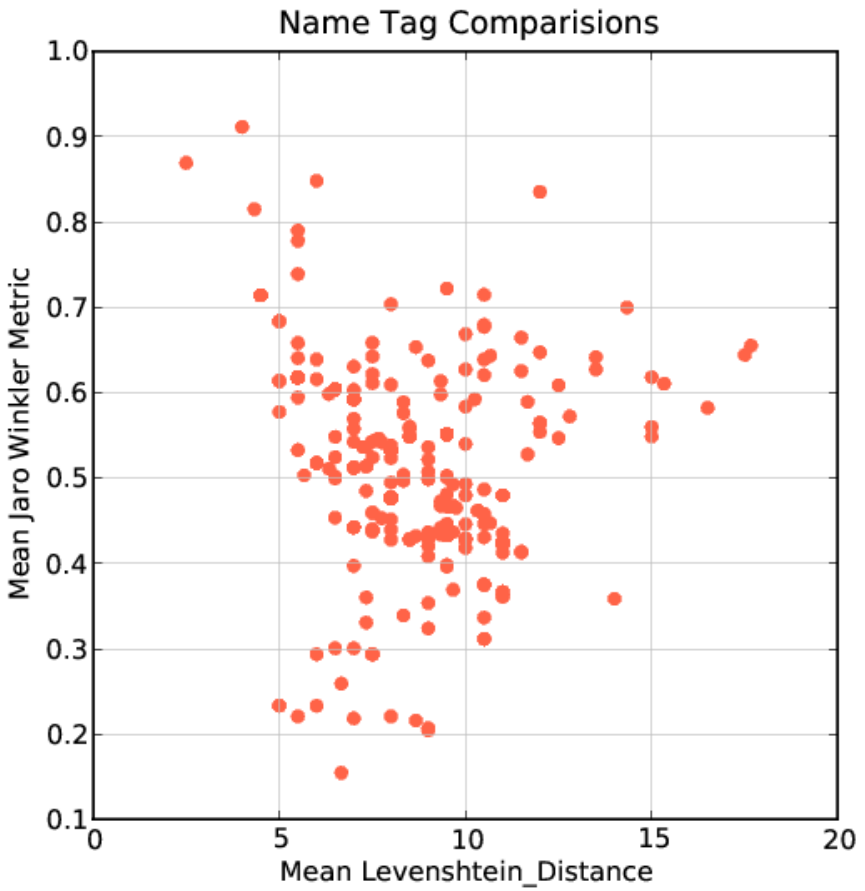
Austria (corr = 0.018, n = 395)



UK and Ireland (corr = 0.14, N = 858)



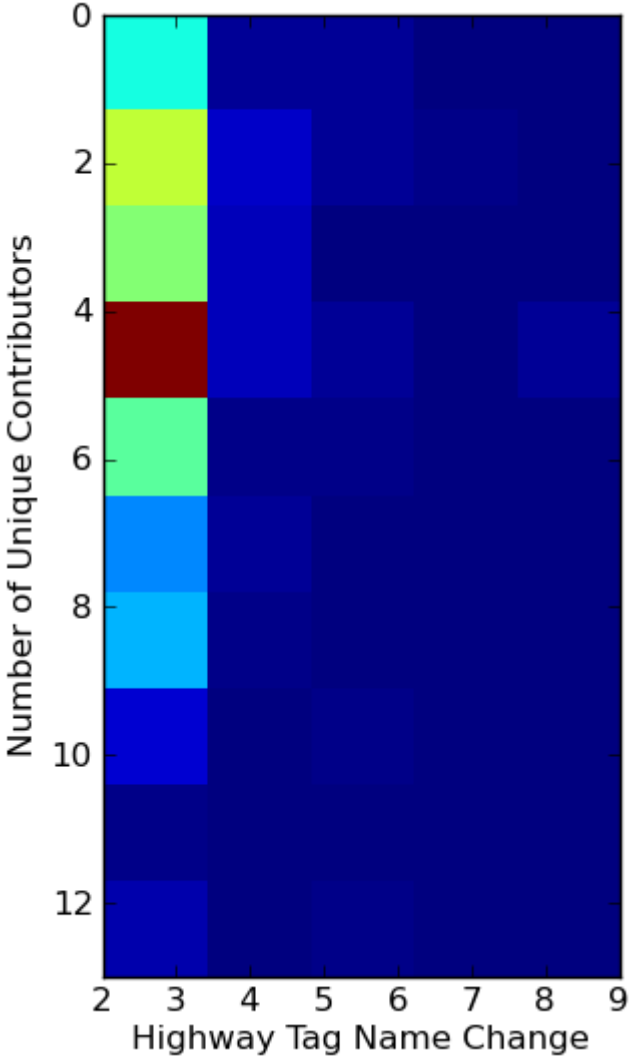
How names change....



- **JaroWinkler distance** (Bilenko et al.; 2003) – duplicate detection
- **Levenshtein distance** (Yujian and Bo; 2007) – string and text transformation
- Clustering around (0.5,10)
- "*Substantial changes between values*"

250 objects – where value assigned to NAME changes 3 or more times over lifetime

The naming of highway objects



- UK and Ireland (**corr = -0.13, N = 381**)
- Local variations
- Spelling errors
- Contributor disputes

Some name change examples

England (24276789, 2 contributors)
7 Changes
"Oakthorp Drive"
"Over Green Drive"
"Oak Thorp Cr"
"Oak Thorp Dr"
"Oak Thorp Dr; Broomcroft Rd"
"Oak Thorp Drive"
"Oak Thorpe Drive"

Austria (4771112, 3 contributors)
5 changes
"Raststätte Kapellerfeld"
"Autobahnraststätte Kapellerfeld (in Bau)"
"Autobahnraststätte Deutsch-Wagram (in Bau)"
"Raststation Deutsch-Wagram (in Bau)"
"Raststation Deutsch-Wagram"

Scotland (23602699, 2 contributors)
5 changes . .
"phenox cres"
"Phenoix cres"
"Phenoix crescent"
"Phenoix Crescent"
"Phoennoix Crescent"
"Phoenix Crescent"

Scotland (4755815, 12 contributors)
5 changes . .
"A199"
"Edinburgh Road"
"Milton Road East"

Summary, Conclusions, Future Work

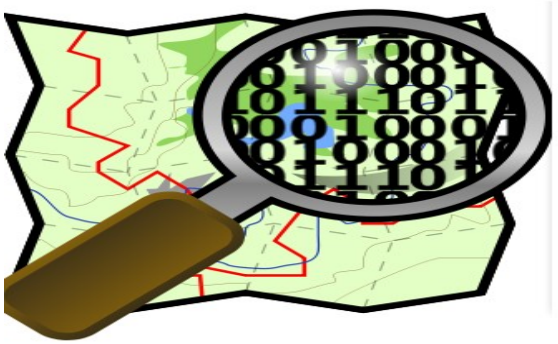
http://www.flickr.com/photos/patrick-smith-photography/5421811605/

Key messages

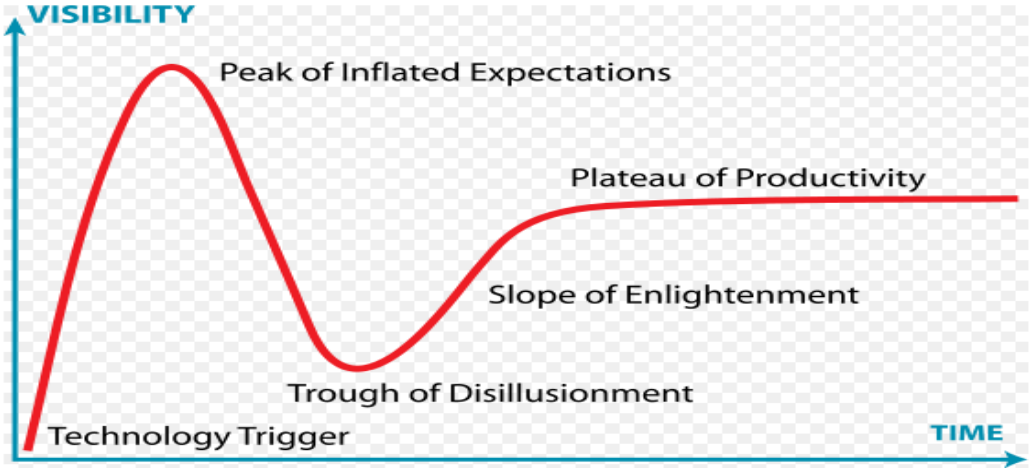
- **Assertion 1:** The OSM database/map for any location “evolves” in a non-linear (un-predictable) manner. **YES (Examples shown)**
- **Assertion 2:** Just as in Wikipedia – tagging conflicts/mis-understandings occur **YES (tag “flip-flopping”)**
- **Assertion 3:** The current “state-of-the-map” can be an unreliable indicator of overall “*quality*” **YES and NO – certainly the map today may be better/worse, [*insert quality metric(s)*] depending on your application/purpose, than yesterday**

Potential for application of research on Wikipedia editing to OSM

- Arazy and Nov (2010) "*local inequality – same article, different editors – global inequality – same editor, different articles*"
- Lifecycle analysis of Wikipedia articles (Wöhner and Peters, 2009)
- Wikipedia – high quality (well written) and incomplete (poorly written) (Zada et al, 2010)
- Thum-Santelli et al (2009) "*Territoriality – an emerging behaviour in online spaces*"



Sustainability of VGI

- The longer-term sustainability of a VGI initiative depends upon its inherent ability to appeal to one or (hopefully) several important key motivators of its contributors (*Coleman et al, 2010*)
- What will the extent, richness and quality of such data be in say 10 years time? Will it replace current methods of survey, develop independently in parallel or become an increasingly important contribution to formal survey and mapping activity?
- 

Re-defining VGI – Volatile Geographic Information

- “Smaller objects more likely to be missing” (*Girres and Touya, 2010*)
- We have shown volatility in shape representation. Causes – different skills, spatial literacy, the “rush to map” (*Haklay, 2010*)
- Some volatility in metadata and attribute info
- Sometimes opposite to Wikipedia (*Kittur and Kraut, 2008*) – as more editors become involved the representation becomes more volatile

Several interesting open questions need immediate attention

- Size of aerial unit (Haklay et al, 2010) or “quantity” suitable for VGI, **metrics** for OSM (Mooney et al, 2010)
- **The contributor dimension** – the quality of the high volume contributors against low volume localised contributors
- Attribute “**accuracy**” or semantics
- Do we forego **completeness**? (Coast, 2009)
- Is OpenStreetMap a road network dataset?
- What do one time contributors add?
- What are the **patterns** of the larger contributors?

Several interesting open questions need immediate attention

- Size of aerial unit (Haklay et al, 2010) or “quantity” suitable for VGI, **metrics** for OSM (Mooney et al, 2010)
- **The contributor dimension**: the quality of the high volume contributors against [illegible] localised contributors
- Attribute “**accuracy**” or semantics
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- Is OpenStreetMap a road network dataset?
- What do one time contributors add?
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Thank You!