GRASS 3D Workshop – 3D-vector data how-to

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Department of Geoinformation Technologies

FOSS4G2006 Workshop

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NVIZ

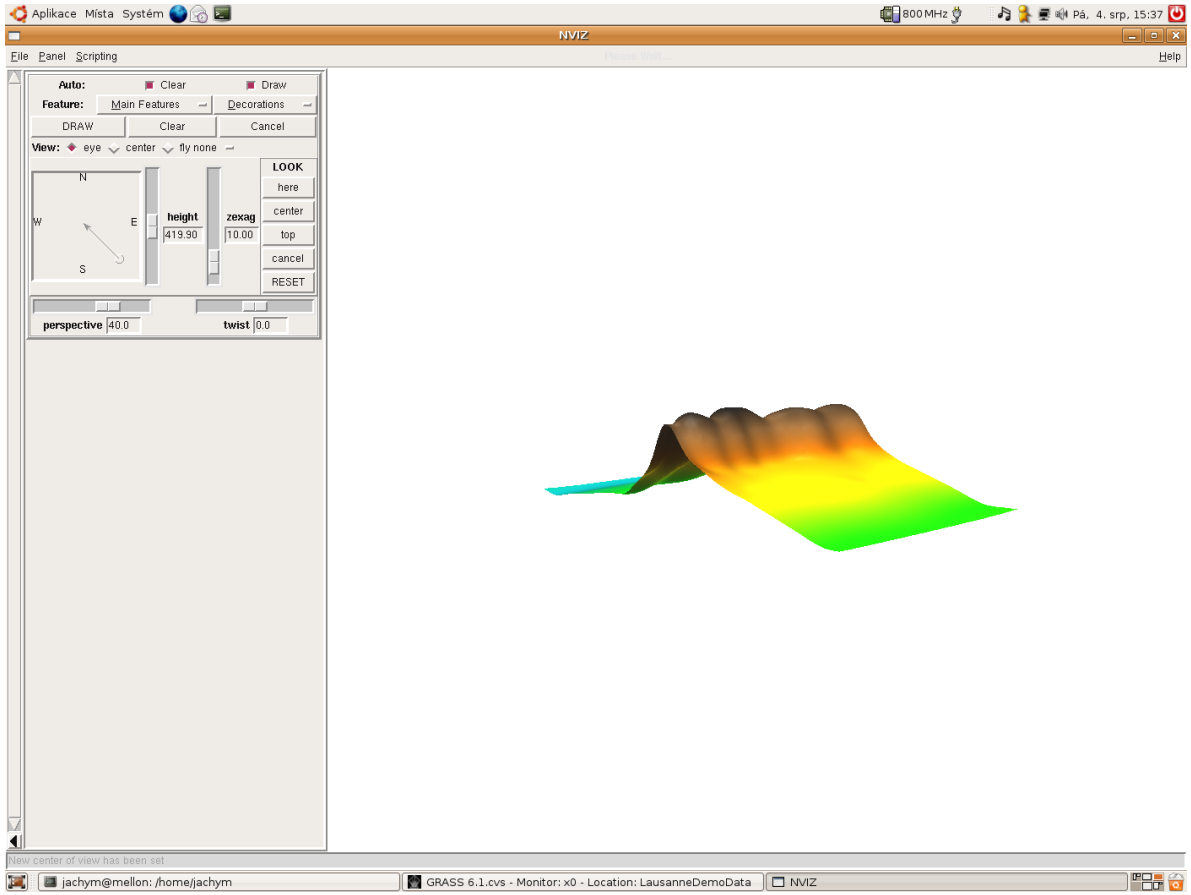
- multiple surfaces in a 3D space
- thematic coloring
- draping GRASS vector files over the surfaces
- `http://grass.itc.it/nviz`

NVIZ

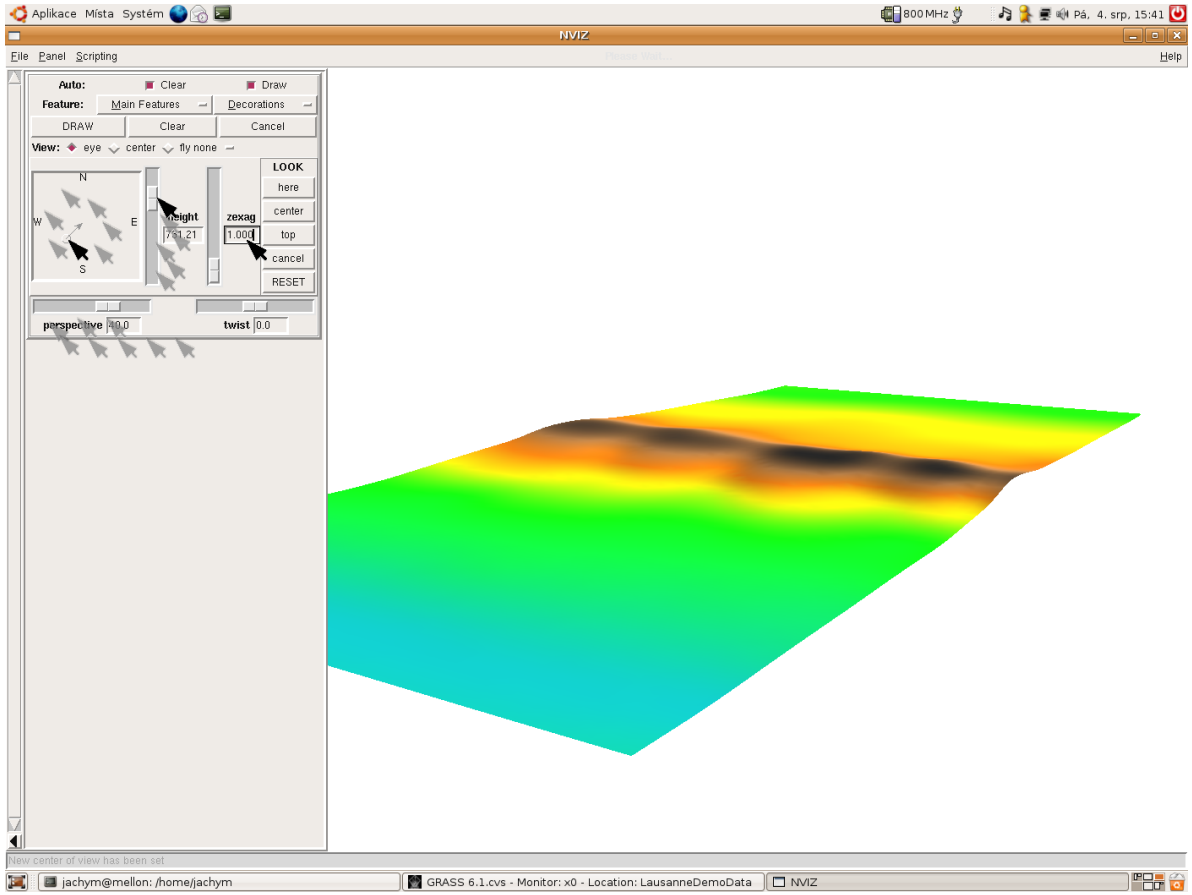
- multiple surfaces in a 3D space
- thematic coloring
- draping GRASS vector files over the surfaces
- `http://grass.itc.it/nviz`

```
$ nviz elev=elevation
```

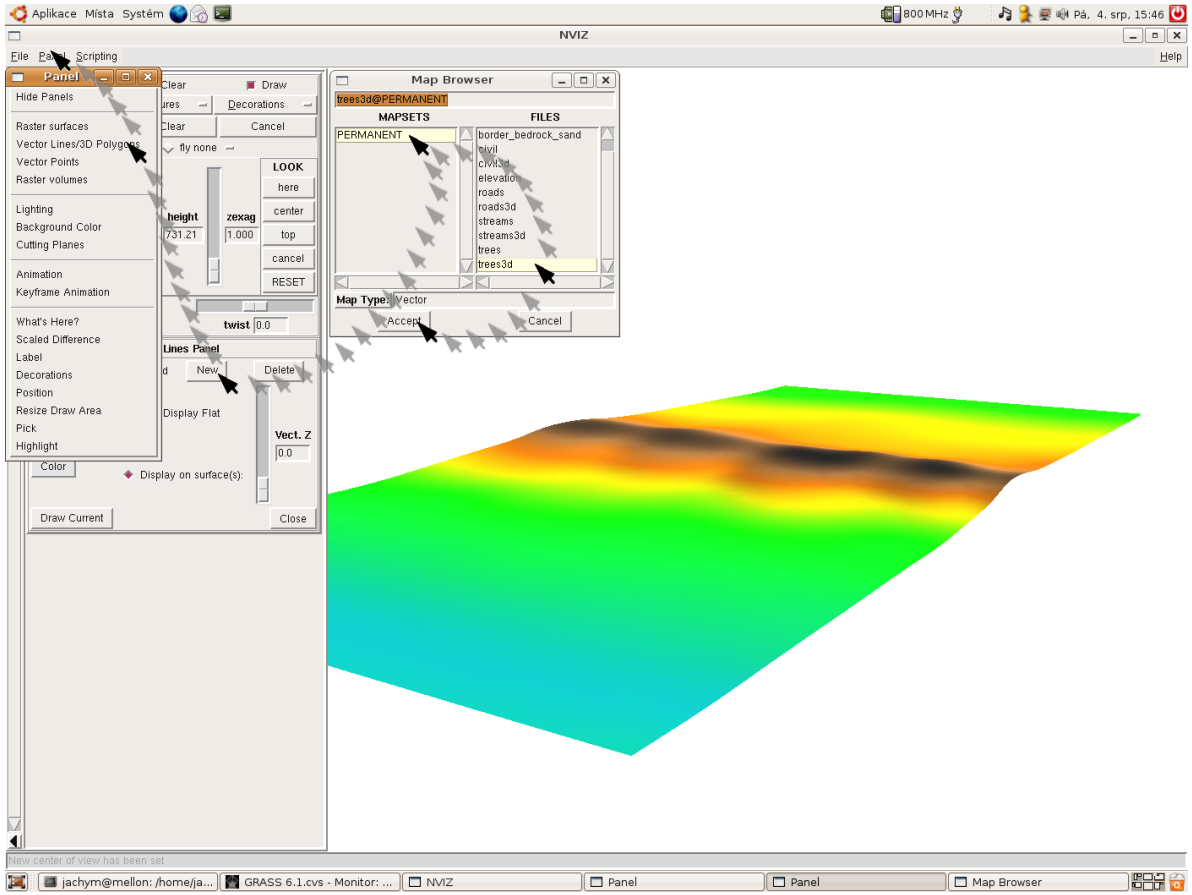
NVIZ


Aplikace Místa Systém
800 MHz
Pá, 4. srp, 15:37
NVIZ
File Panel Scripting
Help
Auto: Clear Draw
Feature: Main Features Decorations
DRAW Clear Cancel
View: eye center fly none
LOOK
here
center
top
cancel
RESET
N
W
E
S
height
419.90
zexag
10.00
perspective 40.0
twist 0.0
New center of view has been set
jachym@mellon: /home/jachym
GRASS 6.1.cvs - Monitor: x0 - Location: LausanneDemoData
NVIZ

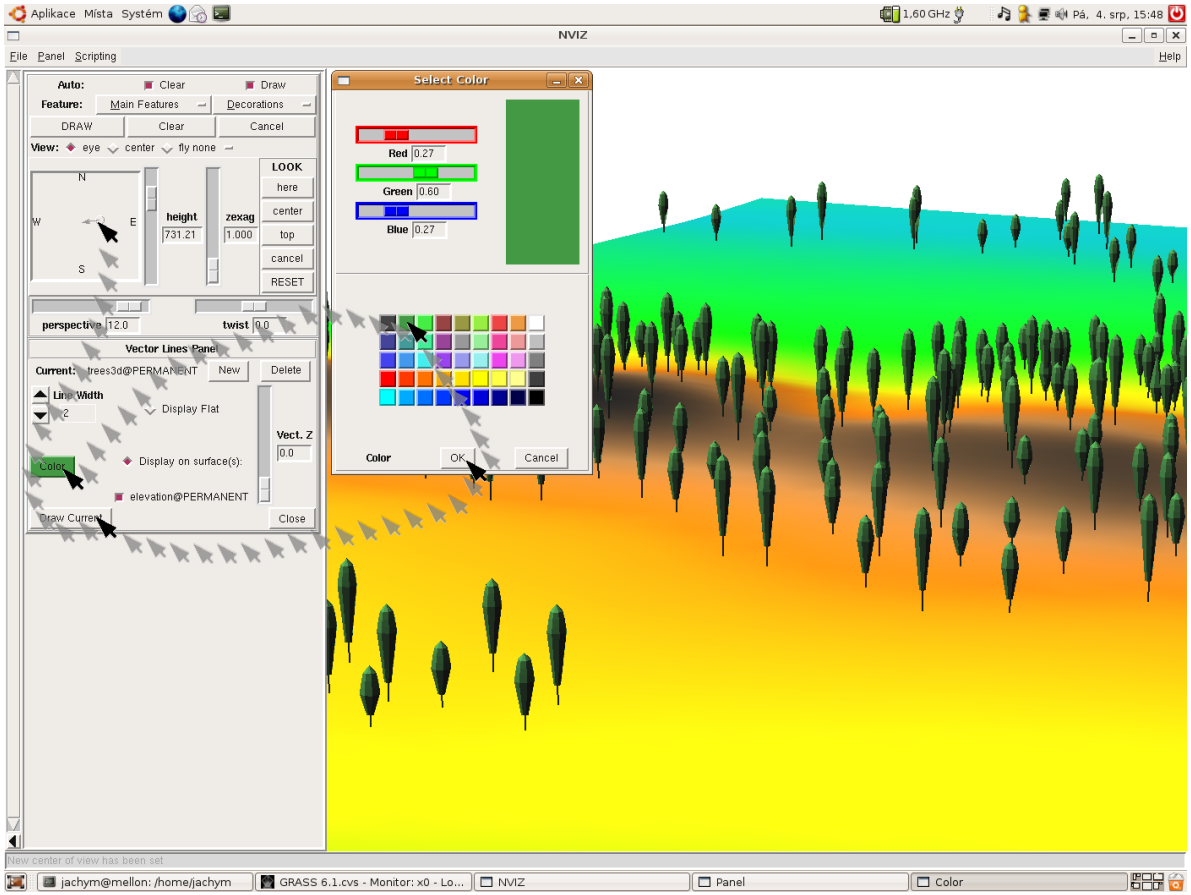
NVIZ


Aplikace Místa Systém
800 MHz
Pá, 4. srp, 15:41
NVIZ
File Panel Scripting
Help
Auto:
Clear
Draw
Feature:
Main Features
Decorations
DRAW
Clear
Cancel
View:
eye
center
fly none
LOOK
here
center
top
cancel
RESET
N
W
E
S
Height
7.31.21
zexag
1.000
perspective
0.0
twist
0.0
New center of view has been set
jachym@mellon: /home/jachym
GRASS 6.1.cvs - Monitor: x0 - Location: LausanneDemoData
NVIZ

NVIZ


NVIZ
Panel
Hide Panels
Raster surfaces
Vector Lines/3D Polygons
Vector Points
Raster volumes
Lighting
Background Color
Cutting Planes
Animation
Keyframe Animation
What's Here?
Scaled Difference
Label
Decorations
Position
Resize Draw Area
Pick
Highlight
Map Browser
trees3d@PERMANENT
MAPSETS
FILES
PERMANENT
border_bedrock_sand
elevation
roads
roads3d
streams
streams3d
trees
trees3d
Map Type: Vector
Accept
Cancel
Lines Panel
New
Delete
Display Flat
Color
Display on surface(s):
Draw Current
Close
LOOK
here
center
top
cancel
RESET
height
zexag
twist

NVIZ


Aplikace Místa Systém
1,60 GHz
Pá, 4. srp, 15:48
NVIZ
File Panel Scripting
Help
Auto: Clear Draw
Feature: Main Features Decorations
DRAW Clear Cancel
View: eye center fly none
LOOK
here
center
top
cancel
RESET
height 731.21
zexag 1.000
perspective 12.0
twist 0.0
Vector Lines Panel
Current: trees3d@PERMANENT New Delete
Line Width 2
Display Flat
Color
Display on surface(s):
elevation@PERMANENT
Vect. Z 0.0
Draw Current
Close
Select Color
Red 0.27
Green 0.60
Blue 0.27
Color OK Cancel
New center of view has been set
jachym@mellon: /home/jachym
GRASS 6.1.cvs - Monitor: x0 - Lo...
NVIZ
Panel
Color

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GRASS Vector features

- 2D
  - P: point
  - L: line
  - B: boundary
  - C: centroid
- 3D
  - F: face
  - K: kernel

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GRASS-ASCII Vector format

```
$ cat grassdata/LausanneDemoData/PERMANENT\
    /txt/house.txt
B  5 1
 100  100
 500  100
 500  500
 100  500
 100  100
1 1
```

GRASS-ASCII Vector format

```
B   5 1
```

- B – Boundary
- 5 – Number of coordinates
- 1 – Number of layers

GRASS-ASCII Vector format

```
B   5 1
  ...
  500 500
  ...
1 1
```

GRASS-ASCII Vector format

Import of ASCII vector file

```
$ cat grassdata/ ... /txt/house.txt | v.in.ascii -n format=standard \
  out=house
$ d.vect house
```

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Import

- The best module for creation of 3D-vector maps:

Import

- The best module for creation of 3D-vector maps:
  `v.in.ascii`

Import

- The best module for creation of 3D-vector maps:
  `v.in.ascii`

```
v.in.ascii -z in=file.txt out=vector3d
```

Import

- The best module for creation of 3D-vector maps:
  `v.in.ascii`

  ```
  v.in.ascii -z in=file.txt out=vector3d
  ```

  or

  ```
  cat file.txt | v.in.ascii -z out=vector3d
  ```

GRASS-ASCII Vector format

```
$ cat grassdata/LausanneDemoData/PERMANENT\
    /txt/3Dascii-01.txt

B  5 1
 100  100 100
 500  100 100
 500  500 100
 100  500 100
 100  100 100
1 1

$
```

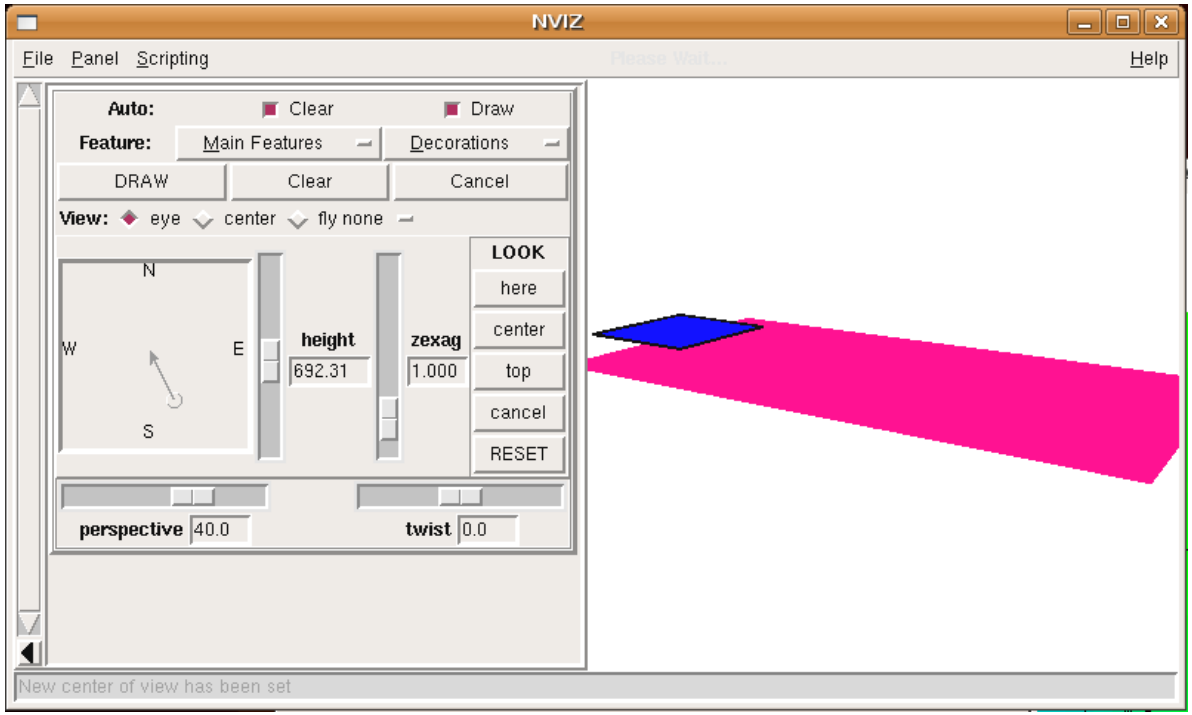
Visualizing first 3D object

```
# creating of new "DEM"
$ r.mapcalc dem=0

# importing ASCII file
$ cat grassdata/LausanneDemoData/PERMANENT/\
    txt/3Dascii-01.txt | \
    v.in.ascii -zn out=bound3d format=standard #--o

# visualize
$ nviz elev=dem vect=bound3d
```

Visualizing first 3D object



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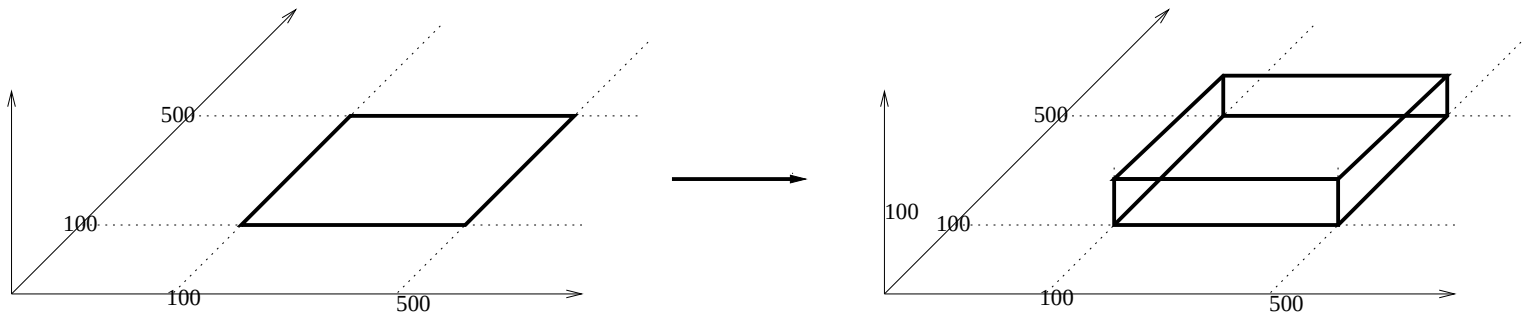
House - 3D Object




```
$ v.out.ascii house  | make_2D_to_3D | v.in.ascii out=house
```

House - 3D Object

```
$ v.out.ascii house format=standard

ORGANIZATION:
DIGIT DATE:
DIGIT NAME:
MAP NAME:
MAP DATE:
MAP SCALE:     1
OTHER INFO:
ZONE:          0
MAP THRESH:    0.000000
VERTI:
B  5 1
 100           100
 500           100
 500           500
 100           500
 100           100
 1     1
```

House - 3D Object

```
$  v.out.ascii house format=standard | \
    grep "^ \([0-9][0-9]\+\.*[0-9]* *\)\{2,3\}" | \
    sed -e "s/\(^ \)\|\( *$\)//g" -e "s/ \+/_/g"
100_100
500_100
500_500
100_500
100_100
$
```

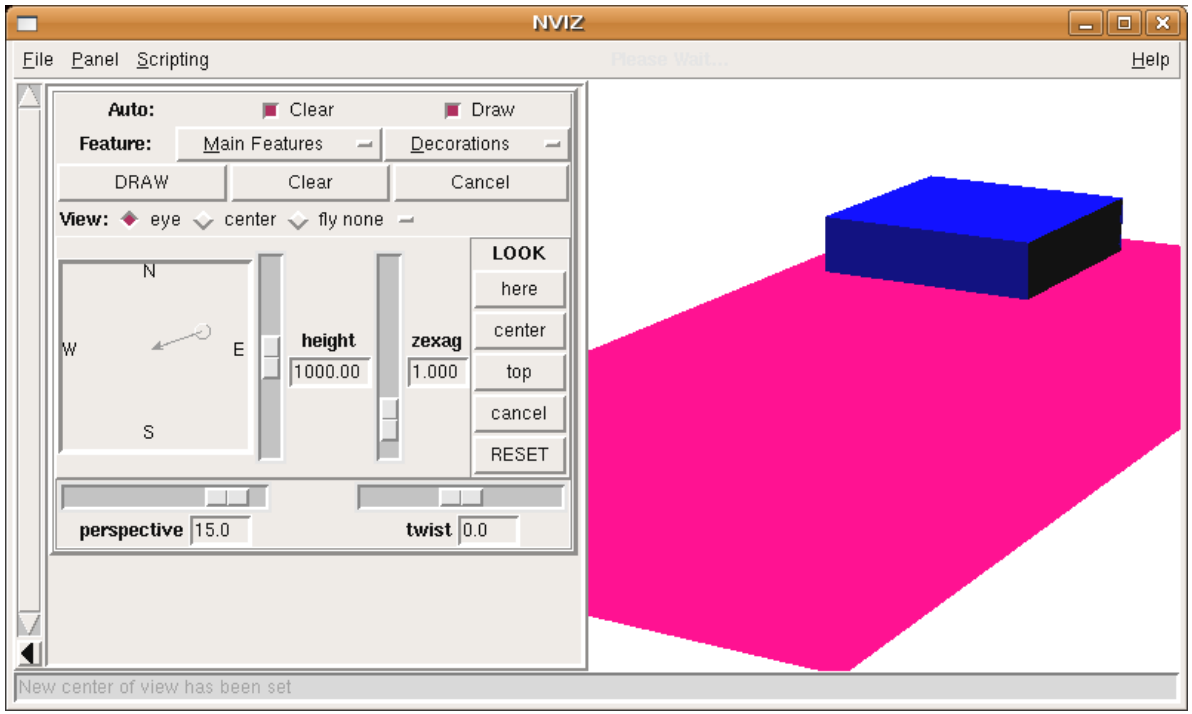
GRASS-ASCII vector format – house

```
#!/bin/sh
last=""
roof="F 5\n"
for line in $(v.out.ascii format=standard in=$1  |\
   grep "^ \+\([0-9][0-9]\+\.*[0-9]* *\)\{2,3\}" |\
   sed -e "s/\(^ \)\|\( *$\)//g" -e "s/ \+/_/g" ); do

    line=$( echo "$line" | sed "s/_/ /g" )

    if [ -n "$last" ]; then
            echo  "F 5";
            echo "$last 0";
            echo "$line  0";
            echo "$line 100";
            echo "$last 100";
            echo "$last 0";
    fi;
    roof="$roof $line 100\n"
    last=$line
done
```

GRASS-ASCII vector format – house

```
$ house_3d.sh house
F 5
100 100 0
500 100  0
500 100 100
100 100 100
100 100 0
F 5
500 100 0
...
$ house_3d.sh house | v.in.asii -nz out=house3d format=standard
$ nviz elev=dem vect=house3d
```

GRASS-ASCII vector format – house



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v.extrude

- Since 2006 in GRASS 6.1 cvs
- 2D-objects (lines and polylines) $\longrightarrow$ 3D-objects
- start height can be set according to digital elevation model
- attribute of the object can be used for object height

v.extrude

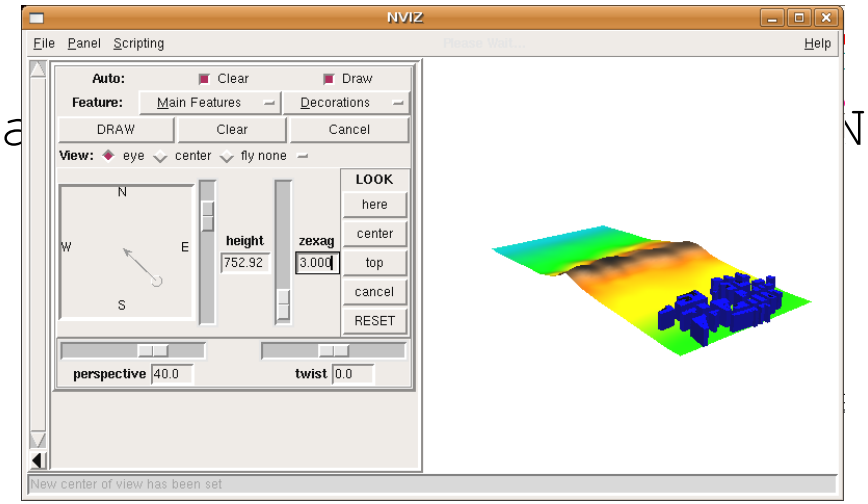
- 2D-vector `industry`

v.extrude

- 2D-vector `industry`
- `db.columns`
  `table=industry`
  `database=grassdata/LausanneDemoData/PERMANENT/dbf/`
  `CAT`
  `height`

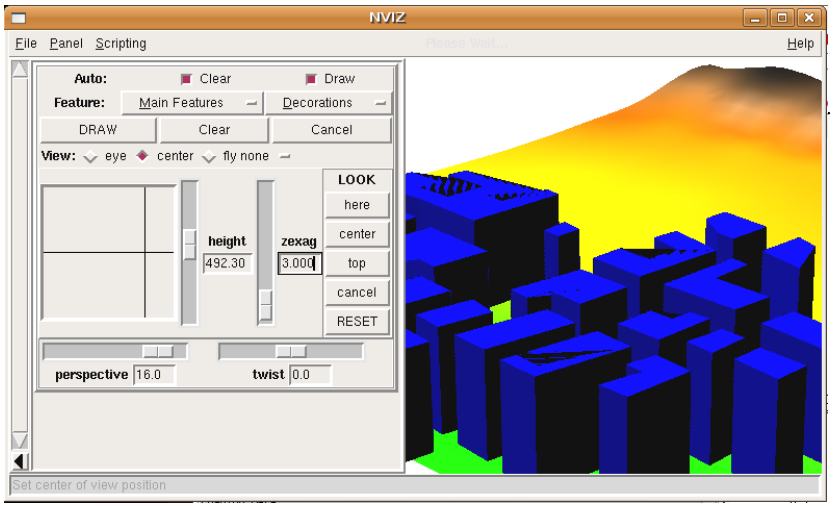
v.extrude

- 2D-vector `industry`
- `db.columns`
  `table=industry`
  `database=grassdata/La` … `NT/dbf/`
  `CAT`
  `height`
- `v.extrude`
  `in=industry`
  `out=industry3d`
  `elev=elevation`
  `hcol=height`



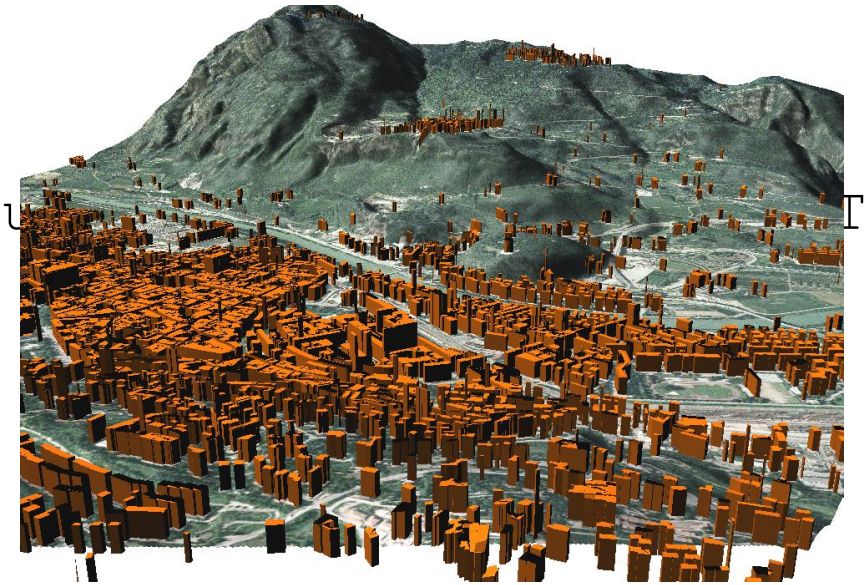
v.extrude

- 2D-vector `industry`
- `db.columns table=industry database=grassdata/La T/dbf/ CAT height`
- `v.extrude in=industry out=industry3d elev=elevation hcol=height`



v.extrude

- 2D-vector `industry`
- `db.columns`
  `table=industry`
  `database=grassdata/Lau...T/dbf/`
  `CAT`
  `height`
- `v.extrude`
  `in=industry`
  `out=industry3d`
  `elev=elevation`
  `hcol=height`



(c) Markus Neteler 2006

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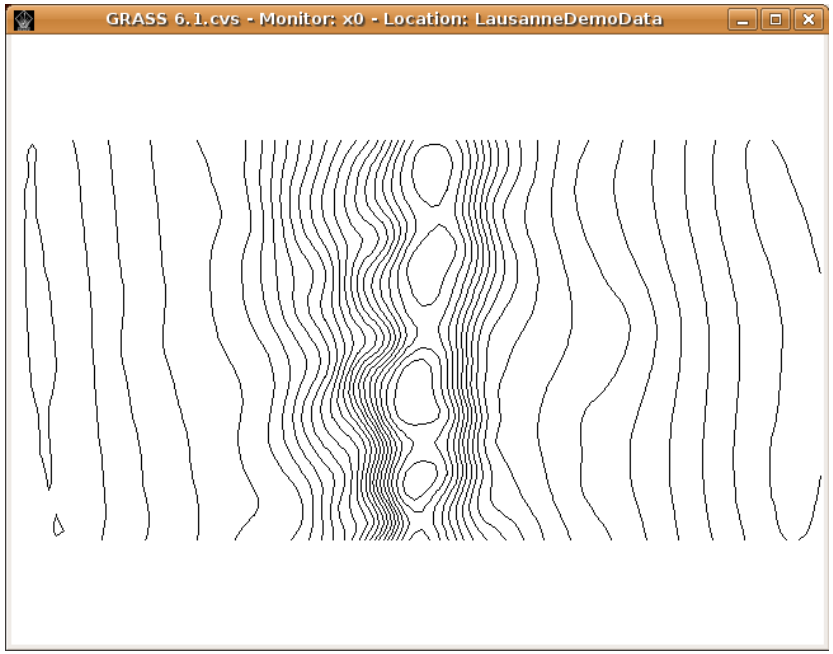
v.drape

- Since 2005 in GRASS 6.1 cvs
- 2D-objects (lines and polylines) $\longrightarrow$ 3D-objects according to digital elevation model

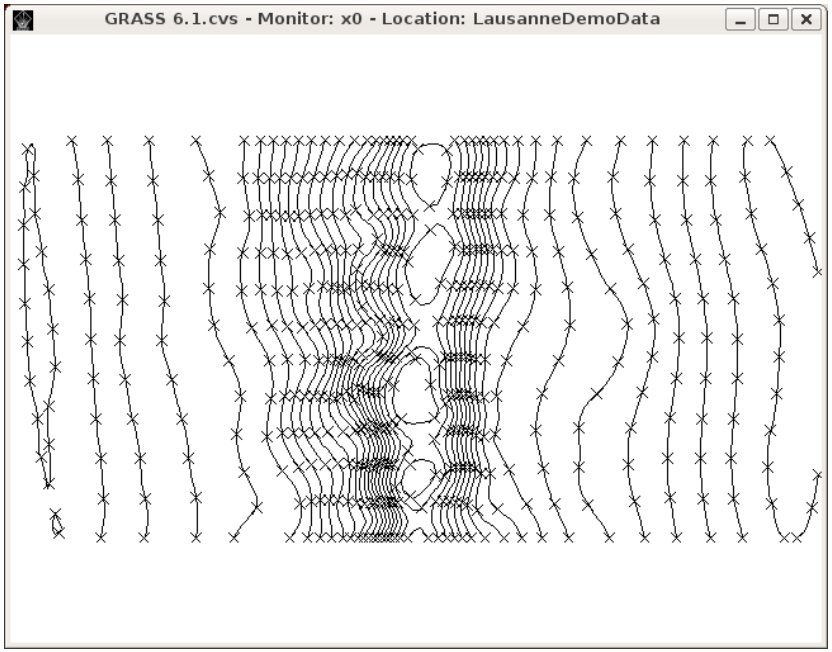
v.drape

- `r.contour in=elevation out=contours step=2`



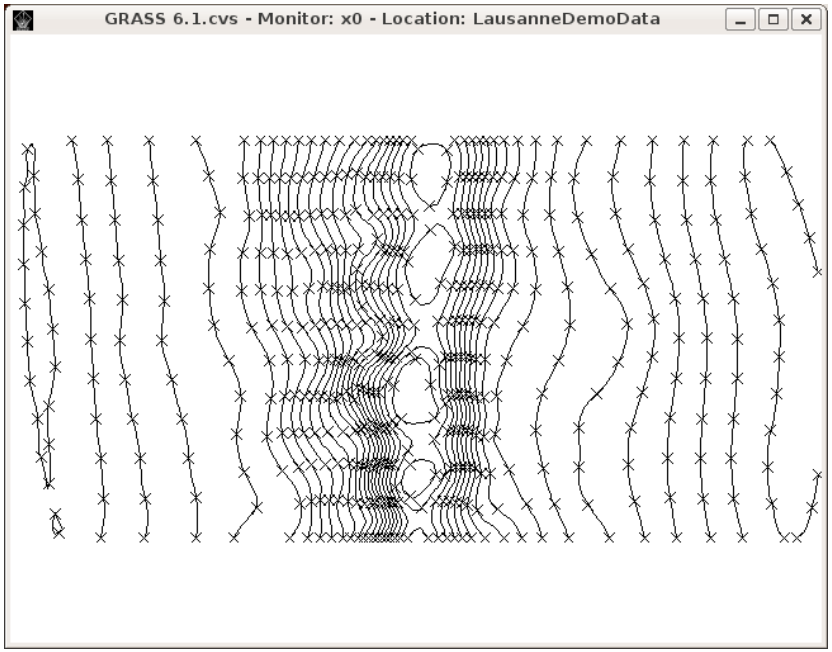
v.drape

- `r.contour in=elevation out=contours step=2`
- `v.to.points in=contours out=points`



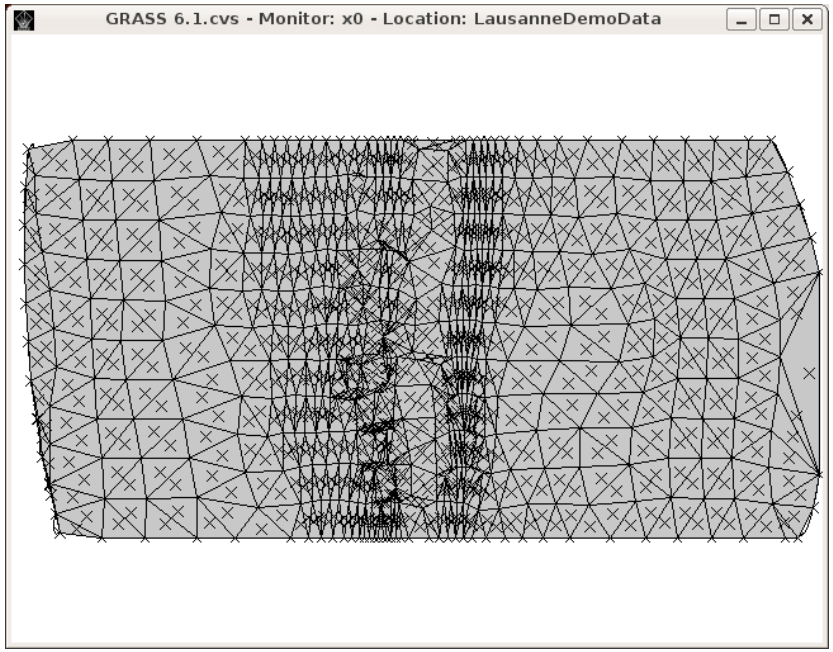
v.drape

- `r.contour in=elevation out=contours step=2`
- `v.to.points in=contours out=points`
- `v.out.ascii in=points|v.in.ascii out=points2d`



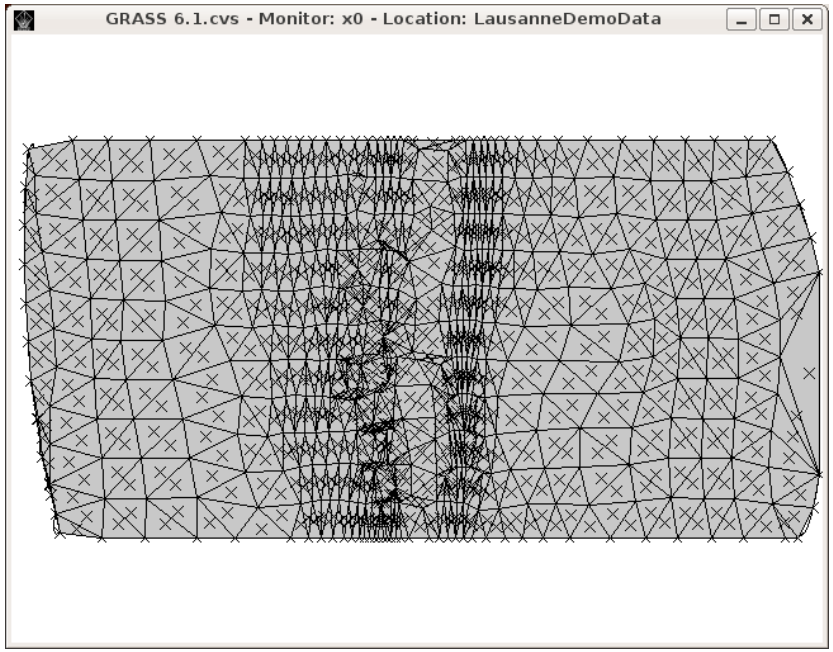
v.drape

- `r.contour in=elevation out=contours step=2`
- `v.to.points in=contours out=points`
- `v.out.ascii in=points|v.in.ascii out=points2d`
- `v.delaunay in=points2d out=tin2d`



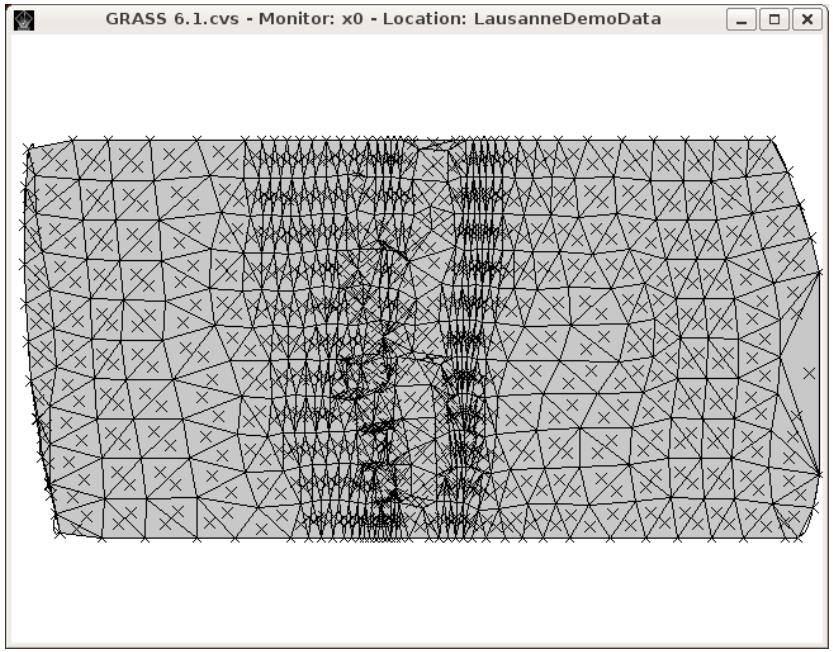
v.drape

- `r.contour in=elevation out=contours step=2`
- `v.to.points in=contours out=points`
- `v.out.ascii in=points|v.in.ascii out=points2d`
- `v.delaunay in=points2d out=tin2d`
- `v.info tin2d`



v.drape

- `r.contour in=elevation out=contours step=2`
- `v.to.points in=contours out=points`
- `v.out.ascii in=points|v.in.ascii out=points2d`
- `v.delaunay in=points2d out=tin2d`
- `v.info tin2d`
- `v.drape in=tin2d rast=elevation out=tin`



v.drape

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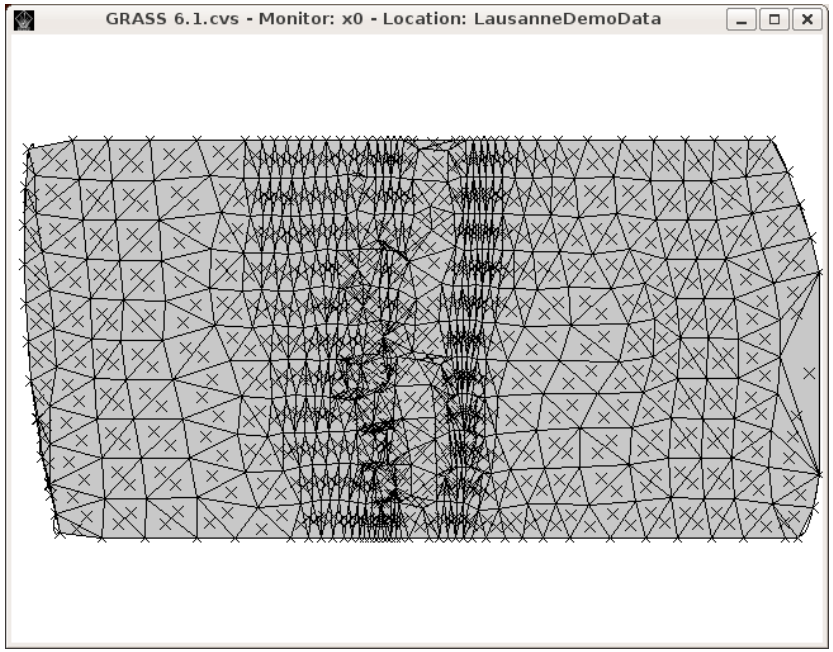
- `v.drape in=tin2d rast=elevation out=tin`
- `v.info tin`



v.drape

- `r.contour in=elevation out=contours step=2`
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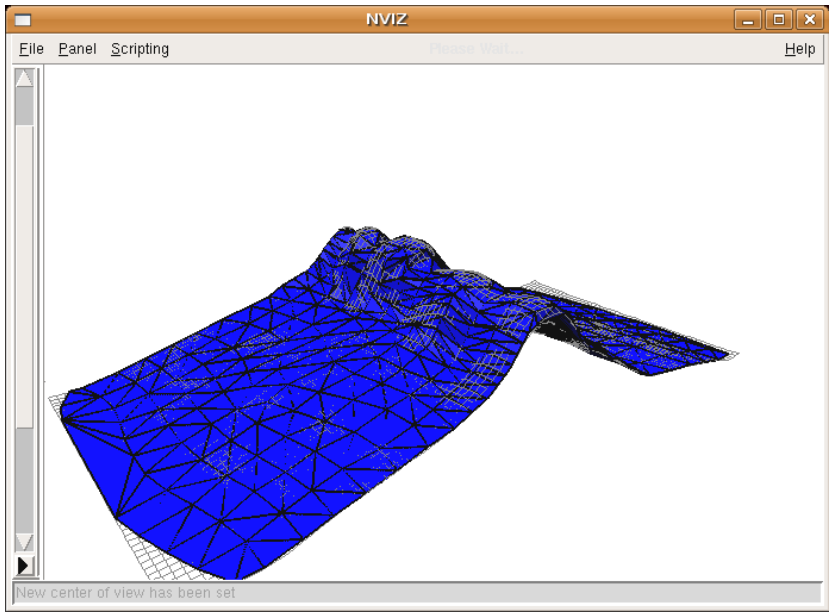
- `v.info tin2d`
- `v.drape in=tin2d rast=elevation out=tin`
- `v.info tin`
- `nviz elev=dem vect=tin`



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v.trees3d

- `http://les-ejk.cz/?cat=grass`
- Developed since 2004 (perl)
- Since 2006 GRASS C-Module
- Purpose: 2D-points $\rightarrow$ 3D-trees [1]

[1] Pretz, Hans 2002:Grundlagen der Waldwachstumsforschung, Parey Buchverlag. Berlin, Wien, ISBN: 3-8263-3223-7, s.208

v.trees3d

- `http://les-ejk.cz/?cat=grass`
- Developed since 2004 (perl)
- Since 2006 GRASS C-Module
- Purpose: 2D-points → 3D-trees [1]
  - `v.trees3d in=trees out=trees3d elev=elevation diam=6` **`height=20`** `hvar=3 vvar=4 hvar=20` **`spruce=50 beech=25 fir=25`**

[1] Pretz, Hans 2002:Grundlagen der Waldwachstumsforschung, Parey Buchverlag. Berlin, Wien, ISBN: 3-8263-3223-7, s.208

v.trees3d

- `http://les-ejk.cz/?cat=grass`
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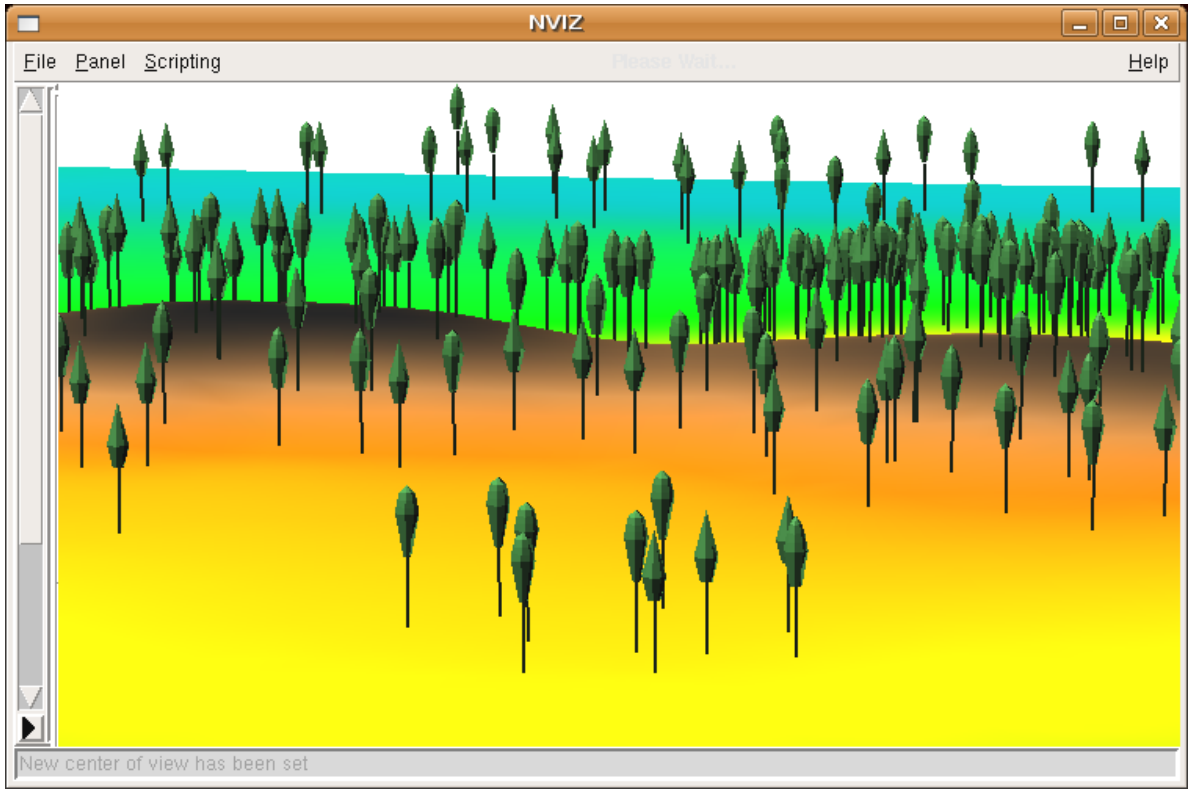
- Since 2006 GRASS C-Module
- Purpose: 2D-points → 3D-trees [1]
  - `v.trees3d in=trees out=trees3d elev=elevation diam=6` **`height=20`** `hvar=3 vvar=4 hvar=20` **`spruce=50 beech=25 fir=25`**
  - `v.trees3d in=trees out=trees3d elev=elevation diam=6` **`hcol=height specol=species`** `hvar=3 clength=60`

[1] Pretz, Hans 2002:Grundlagen der Waldwachstumsforschung, Parey Buchverlag. Berlin, Wien, ISBN: 3-8263-3223-7, s.208

v.trees3d

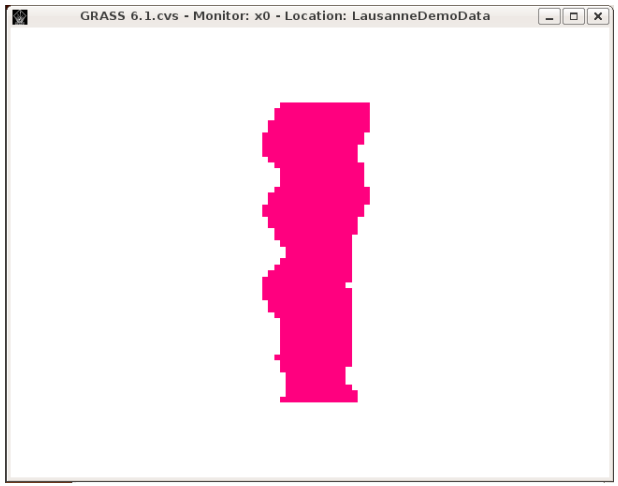



```
v.trees3d in=trees out=trees3d elev=elevation
  hvar=10 vvar=4 spruce=50 beech=25 fir=25
```

v.trees3d

- "Forest" should be up to 350 m

```
r.mapcalc
forest="if(elevation >
350, 1, null())"
```



v.trees3d

- "Forest" should be up to 350 m

```
r.mapcalc
forest="if(elevation >
350, 1, null())"
```

- Trees stubs

```
g.region res=10
r.to.vect in=forest
out=stubs feature=point
```

v.trees3d

- "Forest" should be up to 350 m

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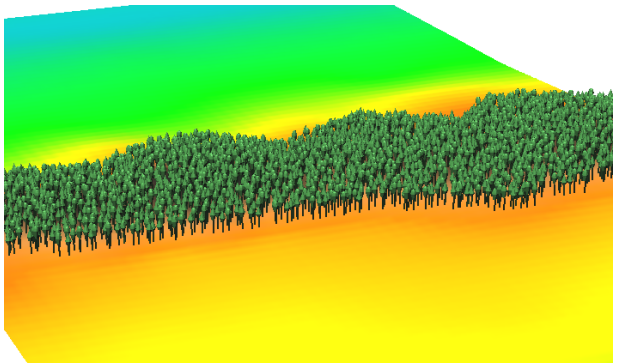
r.mapcalc
forest="if(elevation >
350, 1, null())"
```

- Trees stubs

```
g.region res=10
r.to.vect in=forest
out=stubs feature=point
```

- Tress

```
v.trees3d in=stubs
out=forest3d spruce=50
beech=30 fir=20 hvar=5
vvar=20
elevation=elevation
```



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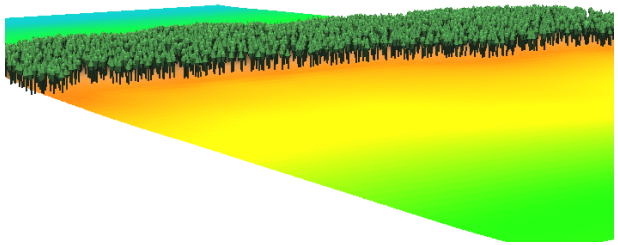

v.trees3d

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forest="if(elevation >
350, 1, null())"
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- Tress

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beech=30 fir=20 hvar=5
vvar=20
elevation=elevation
```

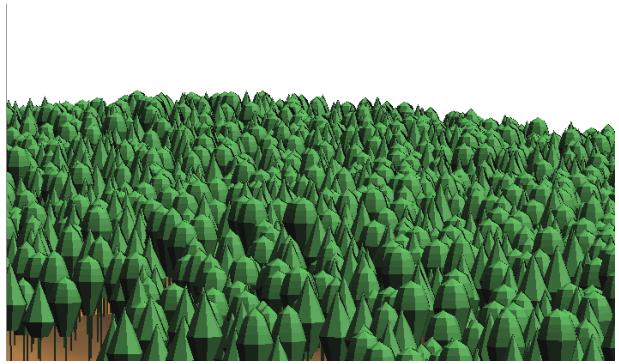

End

jachym.cepicky@centrum.cz
http://Les-ejk.cz

The presentation was reported thanks to GA ČR project nr. 526/03/H036 „Current stage and trends of development of forests in cultural landscape“.