

Offene, dienstebasierte GIS-Architekturen zur Kommunikation von Forschungsergebnissen am Beispiel eines Teilprojektes der internationalen Forschungsinitiative „Risk Habitat Megacity“

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Gliederung

- 1) Forschungsinitiative „Risk Habit Megacity“
- 2) Untersuchungsgebiet
- 3) Hintergrund/Forschungsziele
- 4) Konzept von Risiko und Vulnerabilität
- 5) Räumliches Entscheidungsunterstützungssystem
- 6) Technische Realisierung
- 7) Zusammenfassung/Diskussion

Helmholtz-Gemeinschaft: Zahlen und Fakten

- + 16 Forschungszentren
- + 28.000 Mitarbeiterinnen und Mitarbeiter
- + 8.900 Wissenschaftler und Ingenieure
- + 4.100 Doktoranden
- + Budget: 2,4 Milliarden Euro pro Jahr



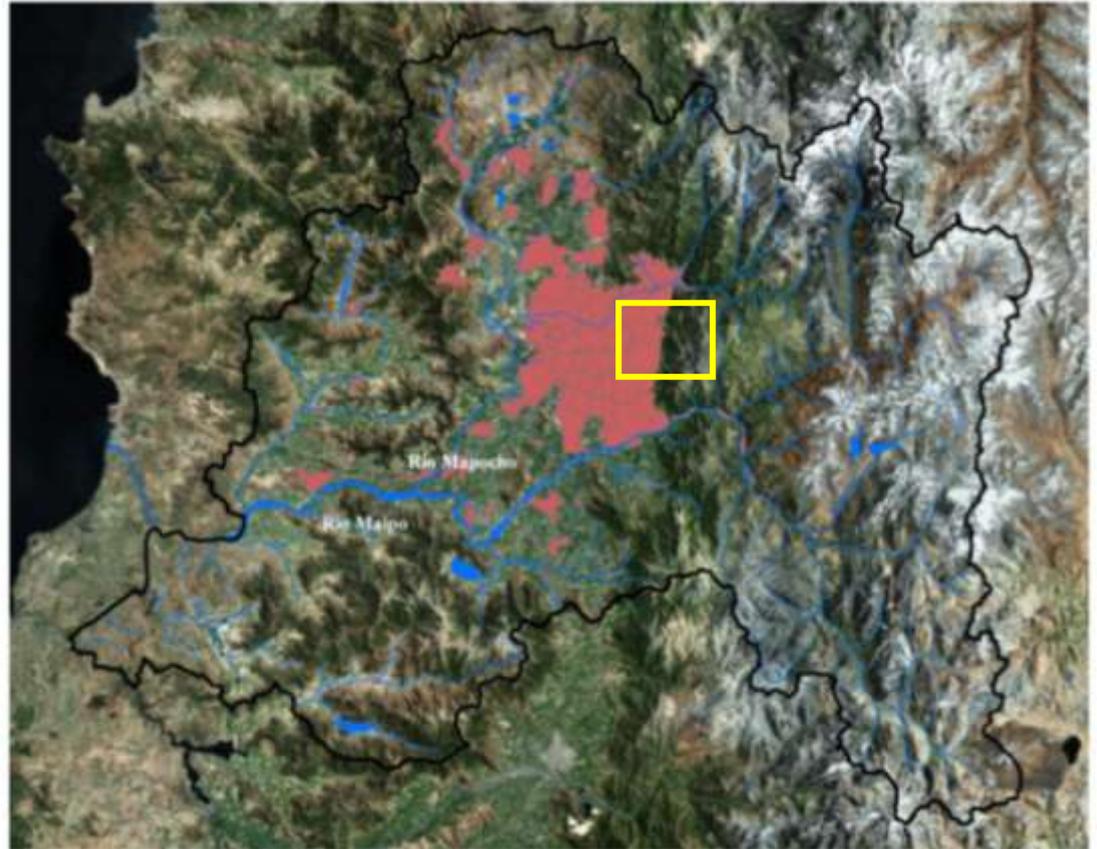
Stammsitz Helmholtz-Zentrum ■
Zweigstelle ■
Helmholtz-Geschäftsstelle ■

Die Forschungsinitiative „Risk Habit Megacity“



- + Helmholtz Forschungsinitiative (Laufzeit: 2007 – 2013)
- + Strategien zur nachhaltigen Entwicklung von Megacities und Urbanen Ballungszentren
- + Finanziert durch den Impuls- und Vernetzungsfonds der Helmholtz-Gemeinschaft
- + Forschungspartner: DLR, Karlsruhe Institute of Technology (KIT), GFZ, Helmholtz Institut für Infektionsforschung
- + Koordinierung: Helmholtz-Zentrum für Umweltforschung (UFZ)
- + <http://www.risk-habitat-megacity.ufz.de/>

Untersuchungsgebiet

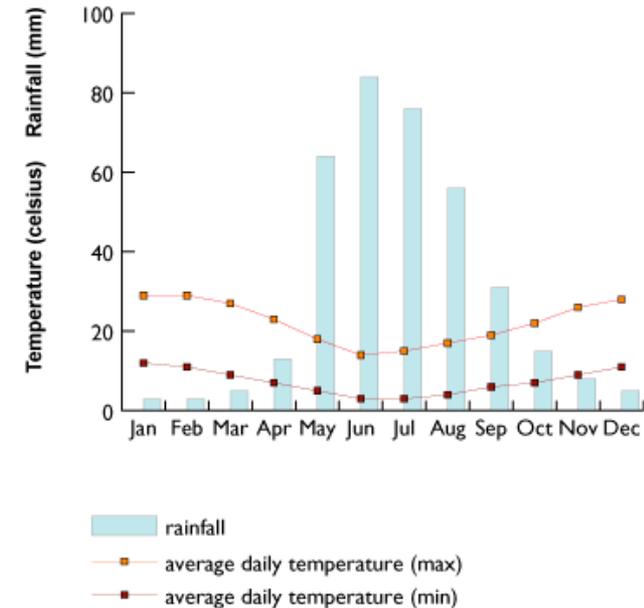


Santiago de Chile
Kommunen La Reina & Peñalolén

Quelle: Bing Maps/ArcGISOnline/OTAS

Hintergrund

- + Veränderungen im Wasserhaushalt (fehlende Retentionsflächen u.a.)
- + Winterregenfälle: Hochwassergefahr steigt
- + Urbanisierung → steigende Bevölkerungszahl
- + großflächige Versiegelung von Grün- und Brachflächen sowie Ackerland
- + Anteil versiegelter Flächen: 32,9% (1993) → 38,6 (2009)
- + Wachsende Anzahl potentiell gefährdeter (vulnerabler/verwundbarer) Personen, Gebäude, Infrastruktur usw.



Hochwassersituation in Santiago de Chile



Forschungsziele des Teilprojektes zur Hochwasserrisikobewertung

- + Informationsgewinn über Hochwasserrisiko
- + Ableitung geeigneter Maßnahmen zur Verminderung des Risikos

- + Voraussetzung:
 - > Verständnis für relevante Prozesse und deren Abhängigkeiten
 - > möglichst genaue Kenntnis der Risikofaktoren
 - > Beteiligung lokaler Entscheidungsträger/Expertenwissen
 - > Kommunikation von Forschungsergebnissen

Konzeptualisierung von Risiko

- + Risiko = Gefahr (Hochwasser) * Risikoelemente * **Vulnerabilität**
- + Anwendung:
 - + Risikomanagement
 - + Raumplanung / kommunale Entscheidungsträger
 - + *evtl. Information für Bevölkerung*

Fokus: Vulnerabilität

- + Vulnerabilität = Verwundbarkeit: soziale & physische Eigenschaften, die Teile eines urbanen Systems anfällig machen, durch Hochwasser Schaden zu erleiden
- + Welche Faktoren machen ein urbanes System oder Teile davon verwundbar?
- + Wie kann Vulnerabilität analysiert werden? Kann Vulnerabilität gemessen werden? Wie kann Vulnerabilität greifbar beschrieben werden?

→ indikatorenbasierte Analyse

Auswahl von Indikatoren zur Analyse und Bewertung der Vulnerabilität (z.B. Gebäudematerial, Anteil von Personen über 65 und unter 5 Jahre)

Bildung eines Vulnerabilitätsindex

Vulnerabilitätsindex:

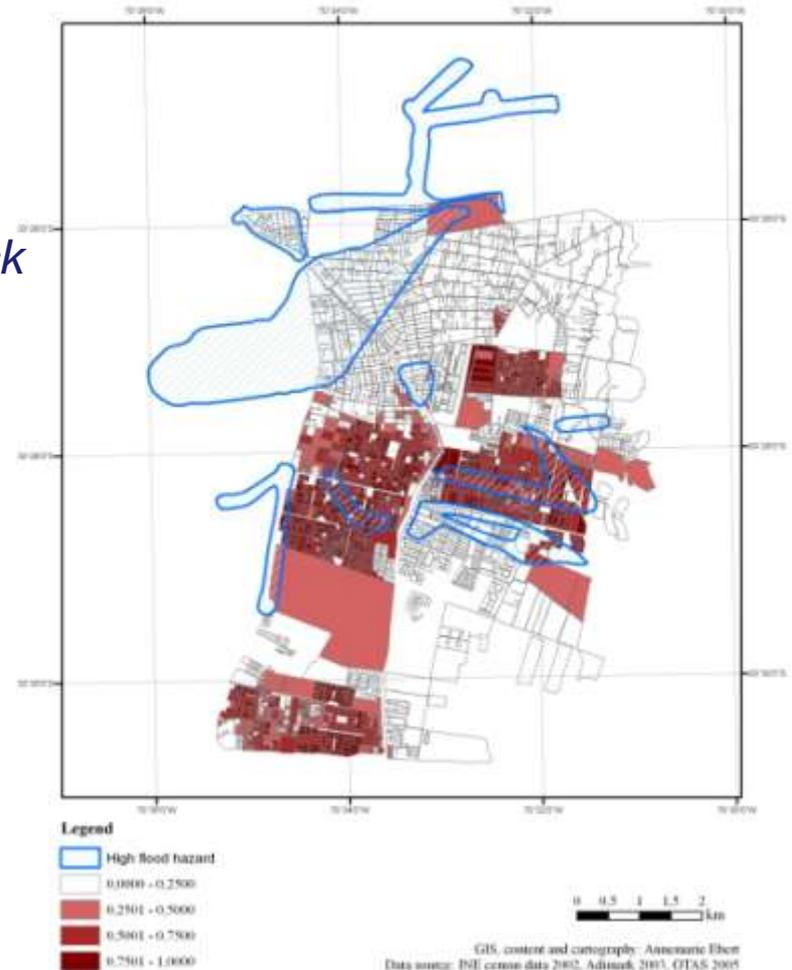
$$VI = \sum (v_i * w_i) / i$$

v_i = relative Häufigkeit pro Gebäudeblock

w_i = Gewichtungsfaktor

i = Anzahl der Indikatoren

Proportion of households belonging to the socio-economic groups D and E per manzana



Herausforderung bei Vulnerabilitätsanalyse

- + Bestimmung der Gewichtung der einzelnen Vulnerabilitätsindikatoren schwierig

Lösung:

- > Befragung der betroffenen Bevölkerung
- > Einbezug der Einschätzung von Entscheidungsträgern/Befragung von Experten
- > räumliche Entscheidungsunterstützungssysteme zum Testen von Szenarien und Einbindung von Entscheidungsträgern

Räumliche Entscheidungsunterstützungssysteme

- + Eignung webbasierter räumliche Entscheidungsunterstützungssysteme in verschiedenen Studien nachgewiesen (WANG & CHENG 2006, KINGSTON 2007)
- + Innerhalb des Projektes zur:
 - > Einbeziehung von Entscheidungsträgern
 - > Berechnung von Szenarien mit unterschiedlichen Gewichten
 - > Kommunikation von Ergebnissen

KINGSTON, R. (2007), Public Participation in Local Policy Decision-Making: The Role of Web-Based Mapping. The Cartographic Journal, 44 (2: ICA Special Issue 2007), 138–144.

WANG, L. & CHENG, Q. (2006), Web-based collaborative decision support services: concept, challenges and application. International Archives of Photogrammetry, Remote Sensing, and Spatial Information Sciences Vol. XXXVI – Part 2, S. 79–84.

Technologische Realisierung

- + Anforderungen:
 - > Webbasierte GIS-Anwendung
 - > Einfache Bedienung
 - > Möglichkeit der Durchführung von Index-Berechnungen durch den Nutzer
 - > Möglichkeit der Einbindung in verschiedene Klienten, OGC-Unterstützung
 - > Einfache Bereitstellung ohne Programmierung
 - > Nutzung vorhandener Infrastrukturen und KnowHow am UFZ

- + Produktauswahl:
 - > ArcGIS Desktop und ArcGIS Server (9.3.1)

Dienstbasierte Architektur (SOA)

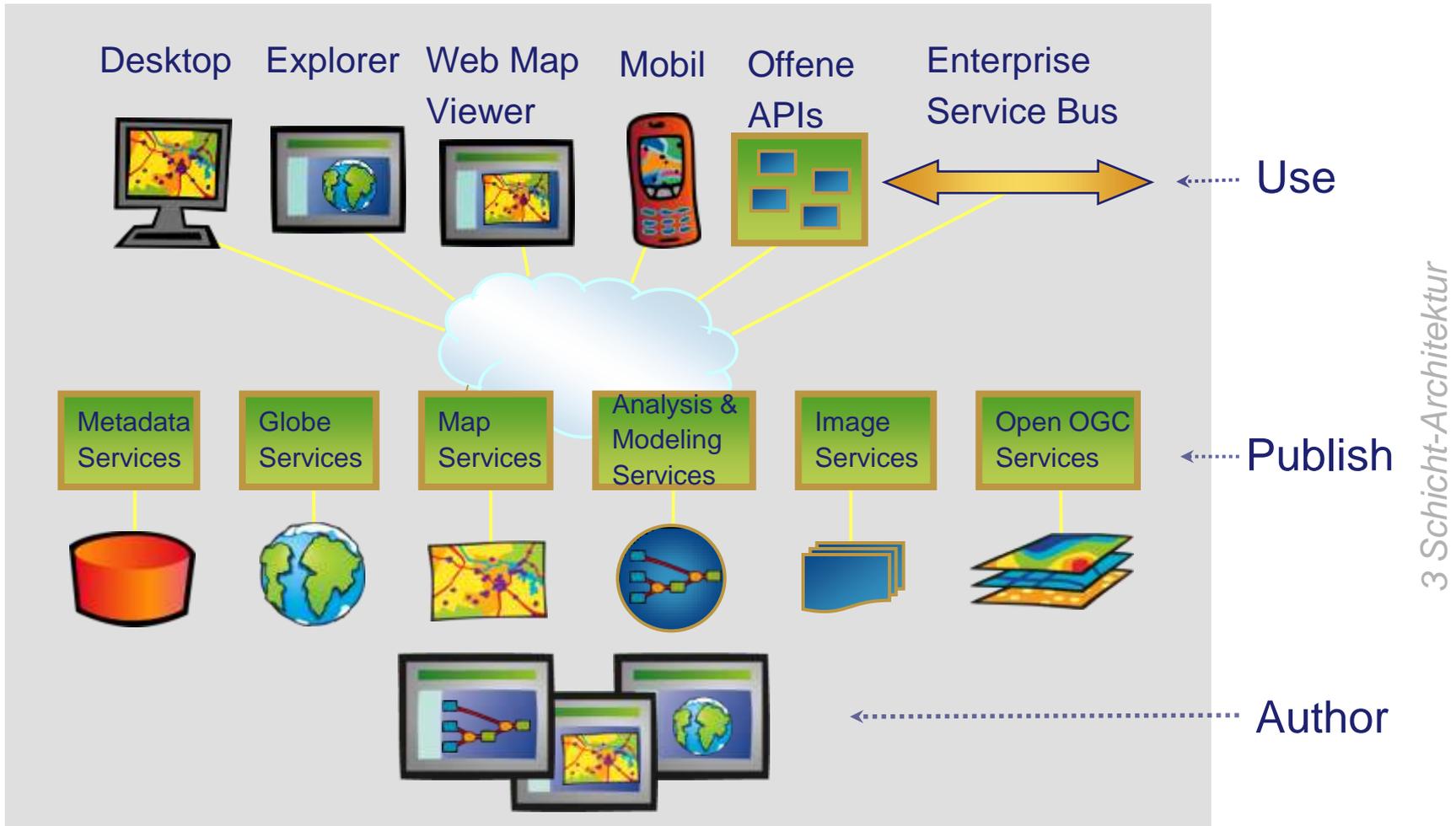
+ Forderung:

- > Möglichst offener und flexibler Zugang zu Geodaten und GIS-Funktionen
- > Herstellerunabhängige Nutzung

+ Lösung:

- > Dienstbasierte Architektur (service-oriented architecture – SOA)
- > Auf spezielle Funktionen spezialisierte Dienste, keine monolithischen Systeme
- > Unterstützung von Standardprotokollen
- > ESRI unterstützt verschiedene Standardprotokolle: SOAP, REST, OGC-konforme Protokolle

ArcGIS: Verschiedene Aufgaben – Eine Infrastruktur



Author – Publish - Use

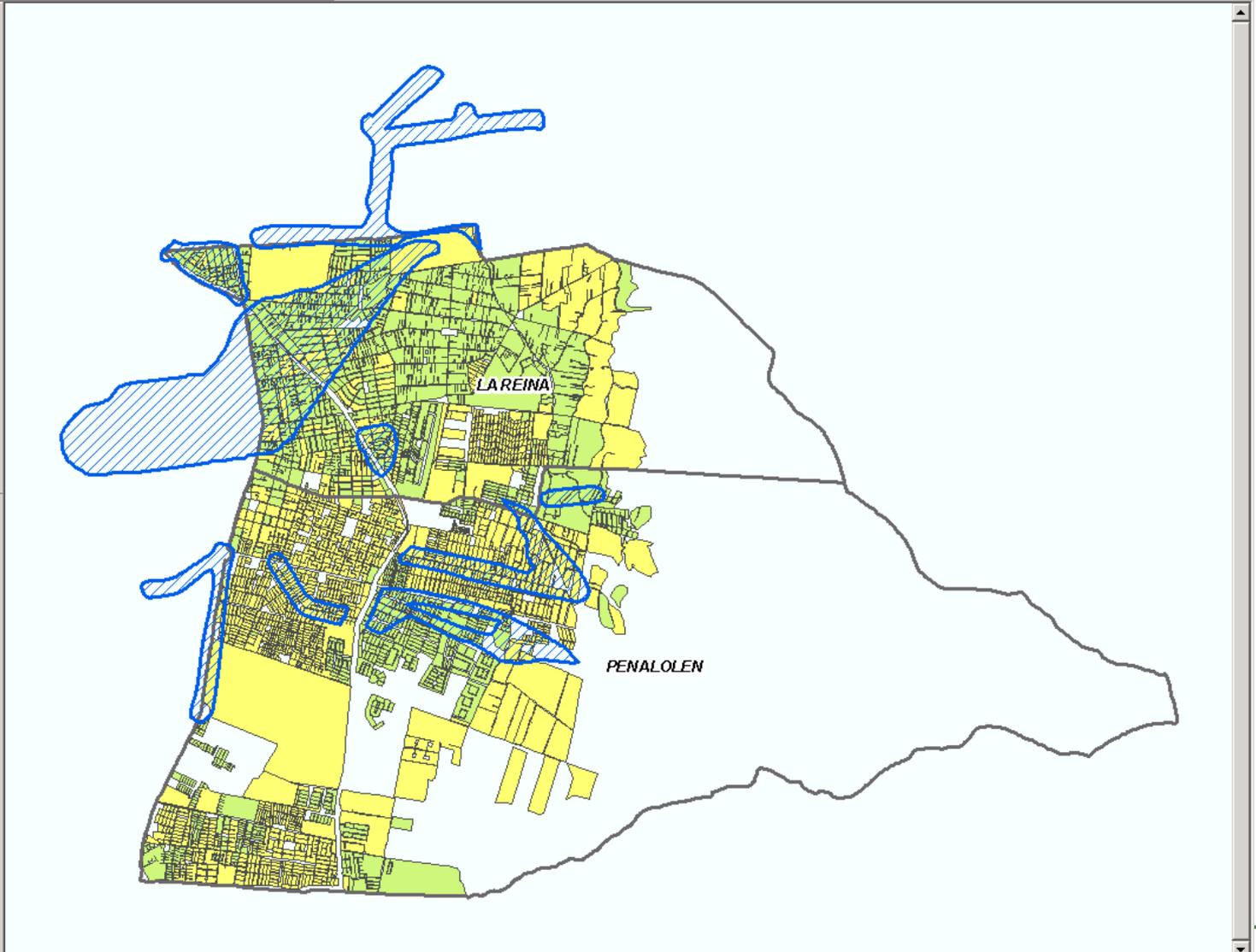
- + Erstellung
 - > Kartendokument für die Darstellung der Daten
 - > Modell zur Berechnung des Vulnerabilitätsindex
- + Veröffentlichung der Dienste auf dem ArcGIS Server
- + Nutzung in verschiedenen Anwendungen (Klienten)



+ Author

Layers

- Flood areas - high hazard level (OTAS)
- Municipalities
- Calculate Vulnerability
- Vulnerability index per manzana
 - V_Index
 - 99.00 - 0.00
 - 0.01 - 1.00
 - 1.01 - 2.00
 - 2.01 - 3.00
 - 3.01 - 4.00
 - 4.01 - 5.00
 - > 5.01
- Number of inhabitants
 - < 100
 - 100 - 200
 - 200 - 300
 - 300 - 400
 - 400 - 500
 - > 500



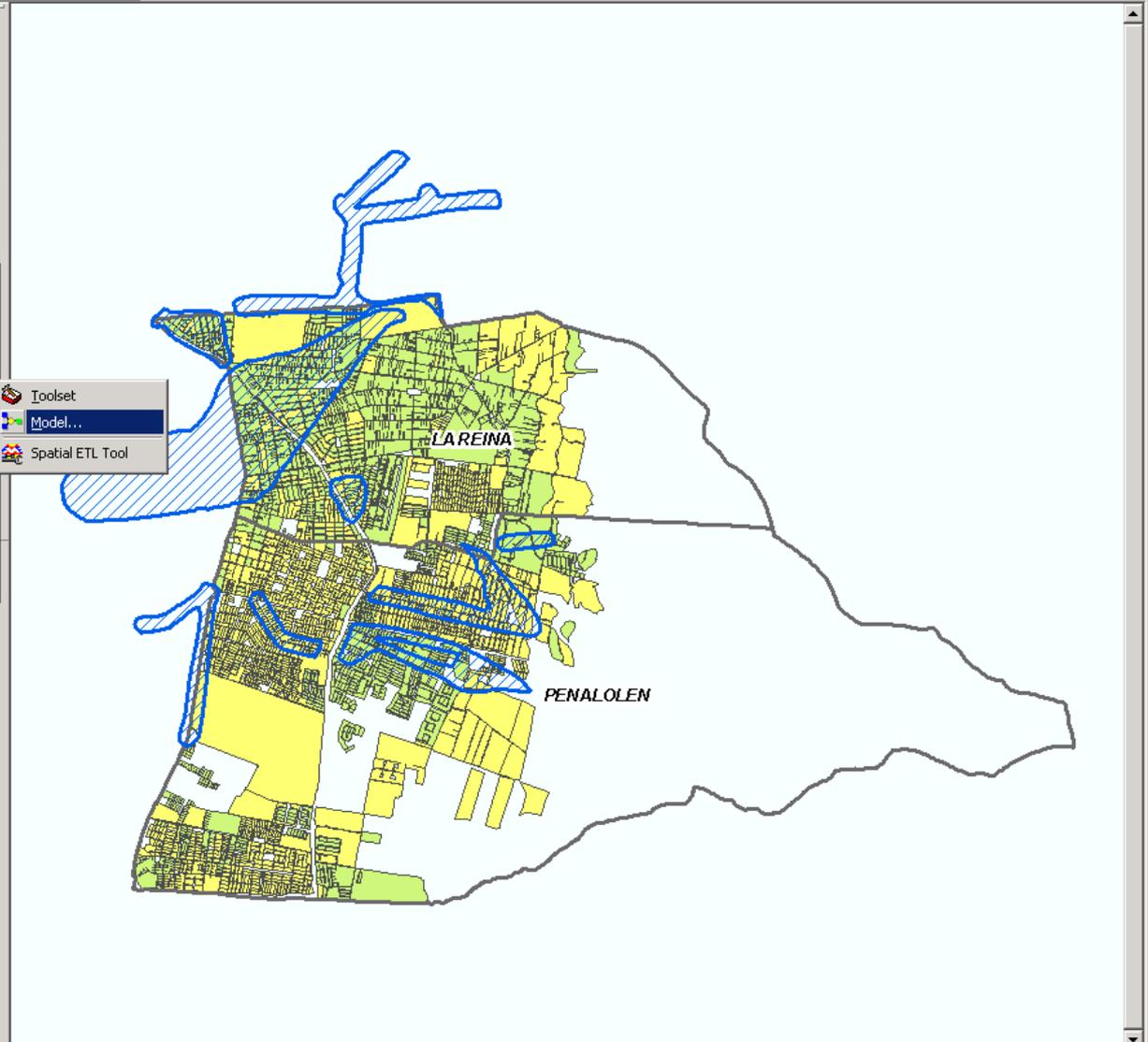
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ArcToolbox

- Analysis Tools
- Cartography Tools
- Conversion Tools
- Data Management Tools
- Geocoding Tools
- Linear Referencing Tools
- Multidimension Tools
- Samples
- Server Tools
- Spatial Statistics Tools
- Vir...

Copy
Paste
Remove
Rename
New
Add
Help
Edit Documentation...
Save As
Publish To ArcGIS Server
Properties...

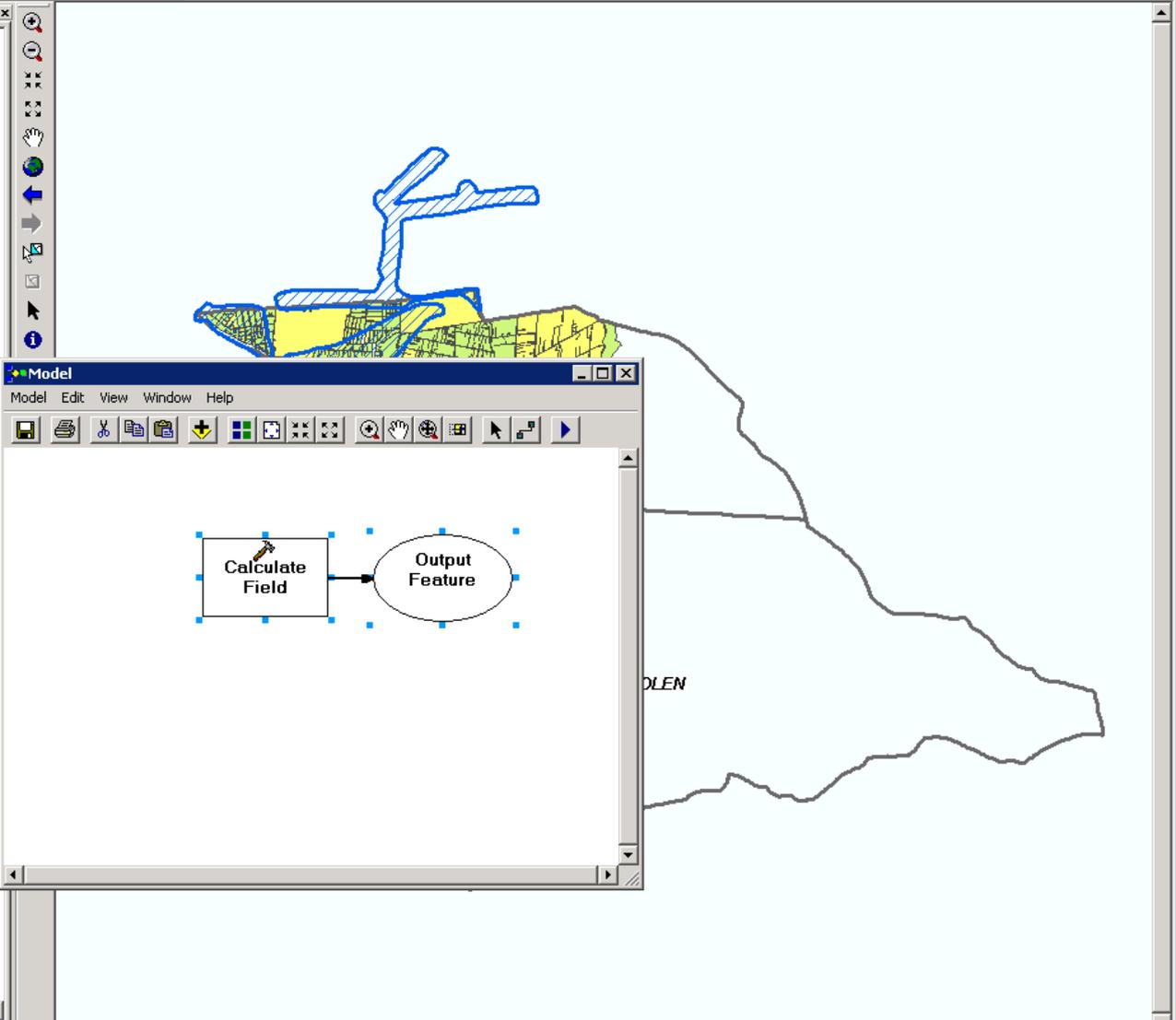


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- Data Management Tools
 - Data Comparison
 - Database
 - Disconnected Editing
 - Distributed Geodatabase
 - Domains
 - Feature Class
 - Features
 - Fields
 - Add Field
 - Assign Default To Field
 - Calculate End Date
 - Calculate Field
 - Delete Field
 - Transpose Time Fields
- File Geodatabase
- General
- Generalization
- Indexes
- Joins
- Layers and Table Views
- Projections and Transformations
- Raster
- Relationship Classes
- Subtypes
- Table
- Topology
- Versions
- Workspace
- Geocoding Tools
- Linear Referencing Tools
- Multidimension Tools
- Samples
- Server Tools
- Spatial Statistics Tools
- VIndex
 - Calculate Vulnerability
 - Model



vulnerability_10.mxd - ArcMap - ArcInfo

File Edit View Bookmarks Insert Selection Tools Window Help

1:73,270

Calculate Vulnerability

Model Edit View Window Help

Layers

- Flood areas - high hazard level (OTAS)
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 - V_Index
 - 99.00 - 0.00
 - 0.01 - 1.00

Calculate Field (13)

Input Table: Vulnerability_Layer (9)

Field Name: V_Index

Expression: $(([v_GSEdye] * [q_GSEdye]) + ([q_fem] * [v_fem]) + ([v_0_4] * [q_0_4]) + ([v_65ymas] * [q_65y$

Expression Type (optional): VB

Code Block (optional):

Calculate Field (13)

Calculates the values of a field for a feature class, feature layer, or raster catalog.

The input table will be modified; a copy should be made to preserve the original information.

Weight no employment

Weight no employment

Calculate Field (10) → Vulnerability_Layer (7)

Calculate Field (11) → Vulnerability_Layer (8)

Calculate Field (12) → Vulnerability_Layer (9)

Calculate Field (13) → Vulnerability_Index_Temp

Display Source Selection Favorites Index Search Results

Drawing

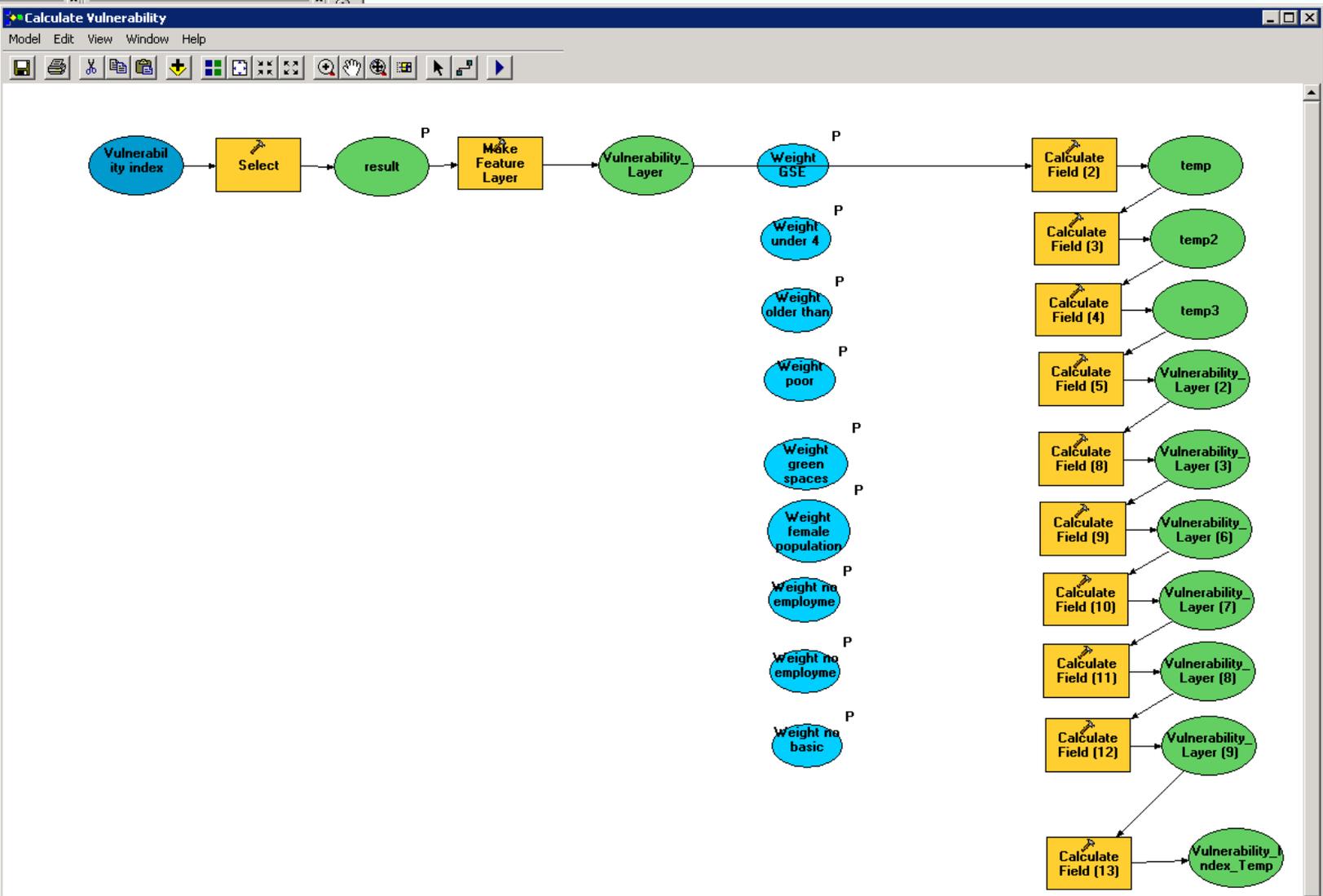
Arial 10

Edits the definition of the selected tool

352297.438 6289763.979 Meters

Layers

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 - V_Index
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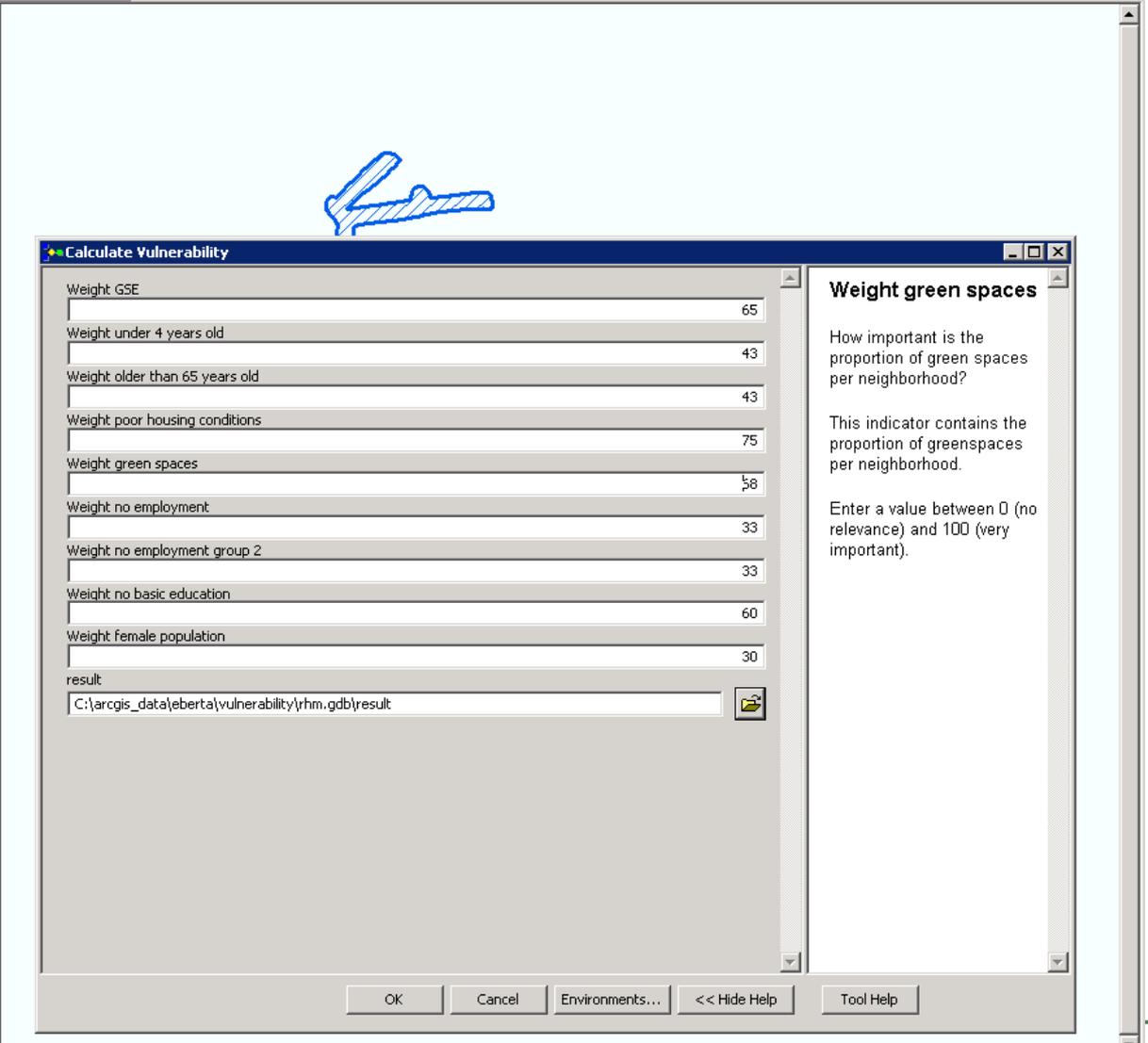


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- VIndex
- Calculate Vulnerability



Calculate Vulnerability

Weight GSE	65
Weight under 4 years old	43
Weight older than 65 years old	43
Weight poor housing conditions	75
Weight green spaces	58
Weight no employment	33
Weight no employment group 2	33
Weight no basic education	60
Weight female population	30
result	

C:\arcgis_data\eberta\vulnerability\rhm.gdb\result

Weight green spaces

How important is the proportion of green spaces per neighborhood?

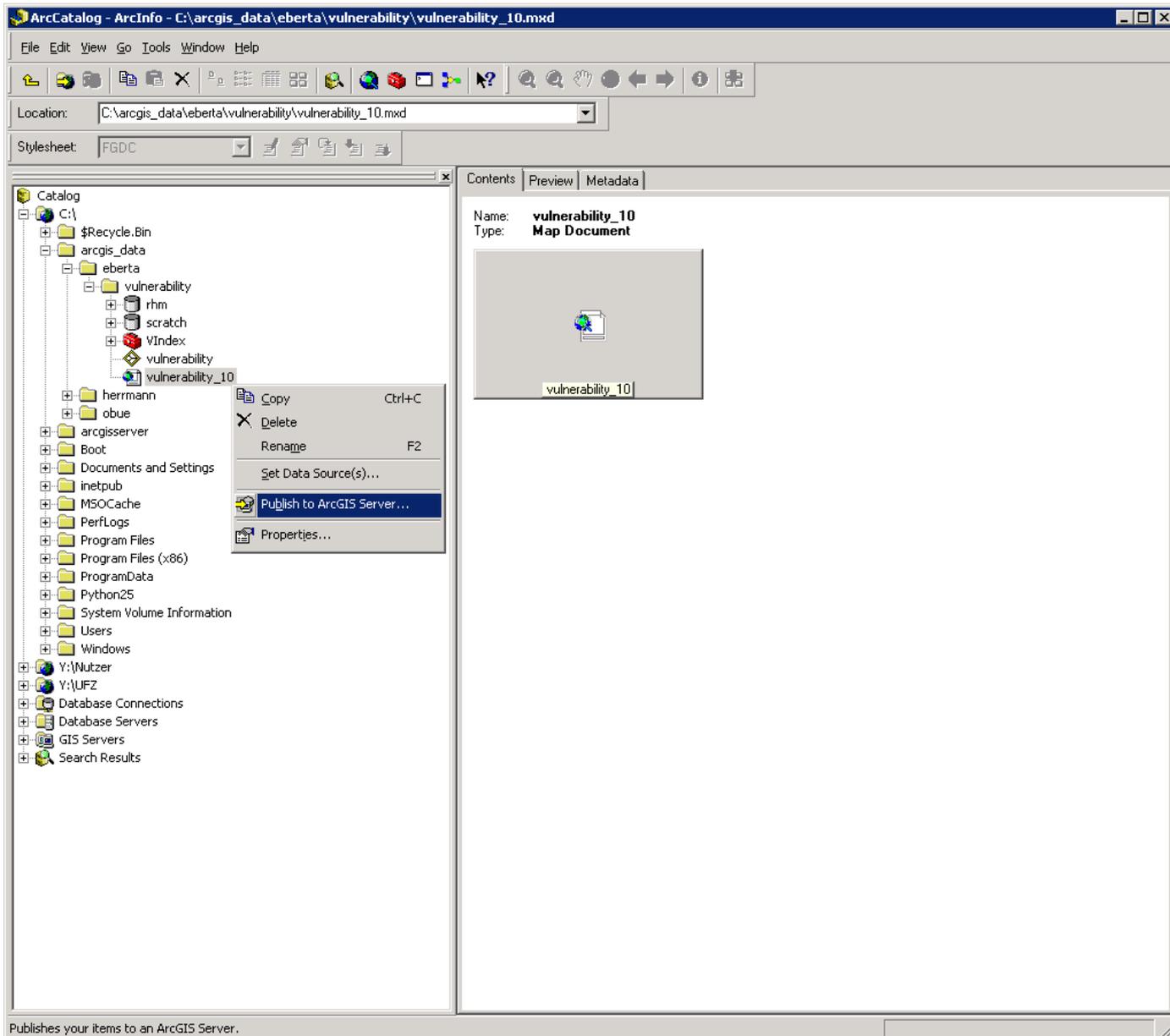
This indicator contains the proportion of greenspaces per neighborhood.

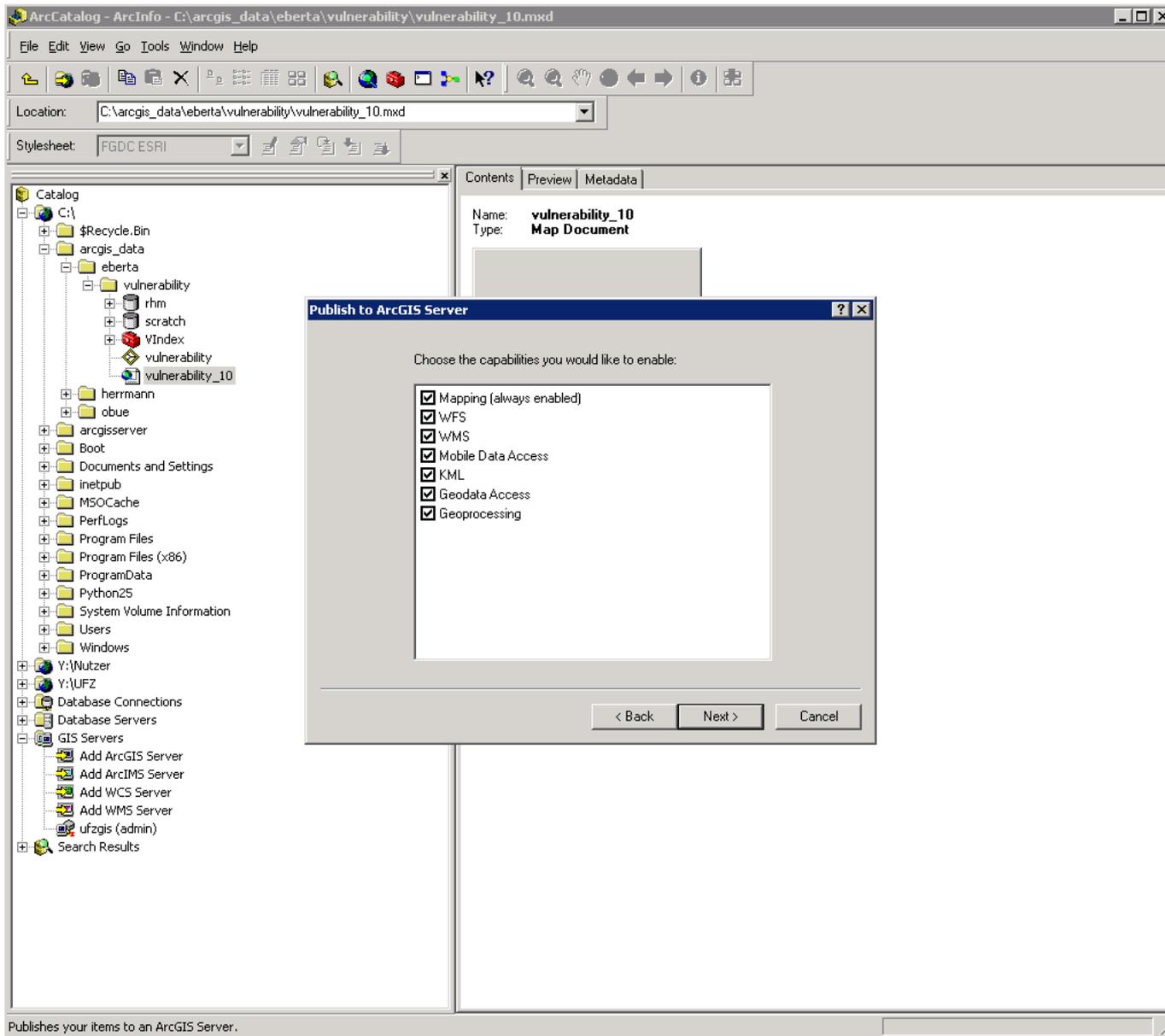
Enter a value between 0 (no relevance) and 100 (very important).

OK Cancel Environments... << Hide Help Tool Help



+ Publish





ArcCatalog - ArcInfo - GIS Servers\ufzgis (admin)

File Edit View Go Tools Window Help

Location: GIS Servers\ufzgis (admin)

Stylesheet: FGDC

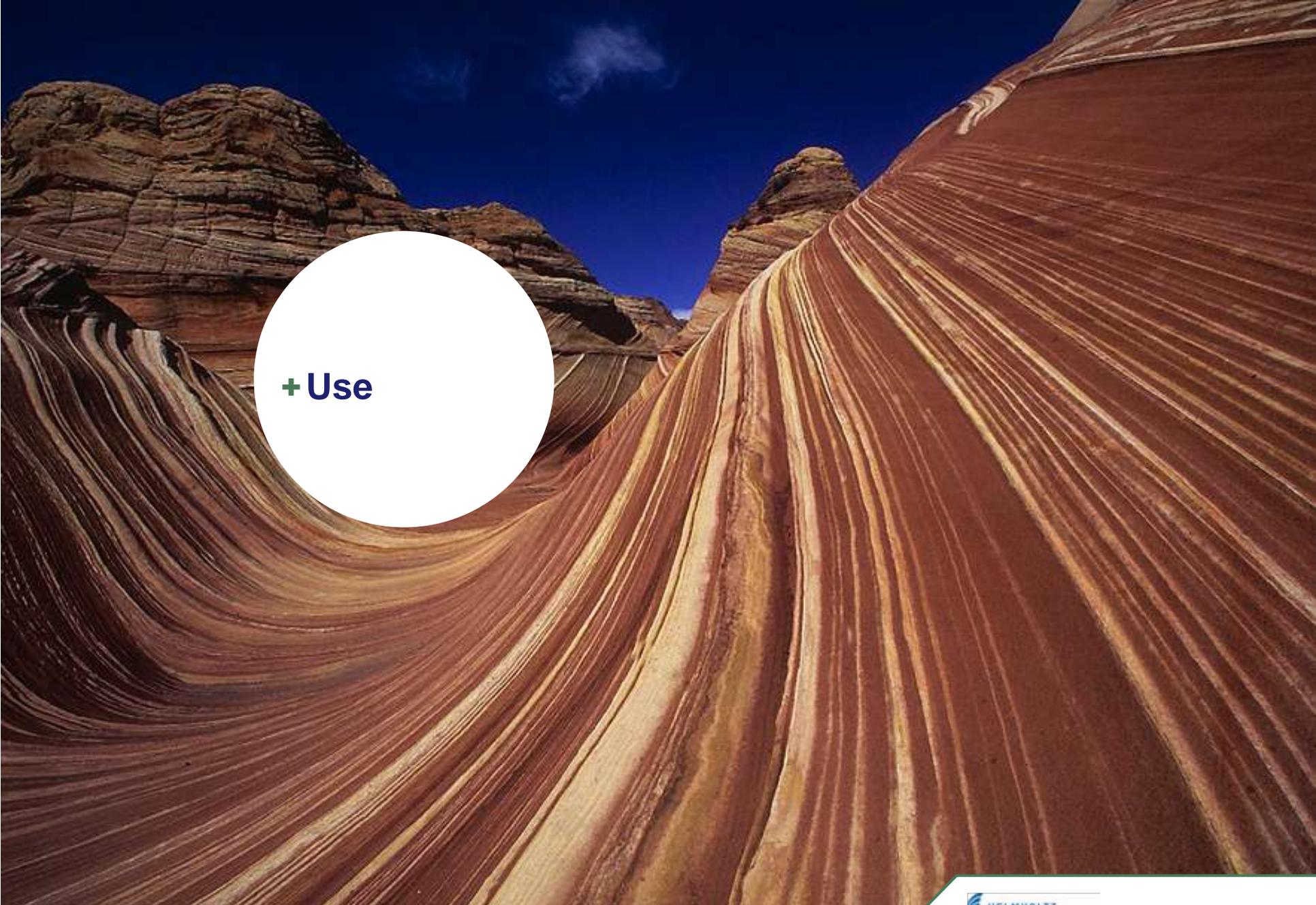
C:\

- \$Recycle.Bin
- arcgis_data
- eberta
 - vulnerability
 - rhm
 - scratch
 - VIndex
 - vulnerability
 - vulnerability_10
 - herrmann
 - obue
- arcgisserver
- Boot
- Documents and Settings
- inetpub
- MSOCache
- PerfLogs
- Program Files
- Program Files (x86)
- ProgramData
- Python25
- System Volume Information
- Users
- Windows
- Y:\Nutzer
- Y:\UFZ
- Database Connections
- Database Servers
- GIS Servers
 - Add ArcGIS Server
 - Add ArcIMS Server
 - Add WCS Server
 - Add WMS Server
 - ufzgis (admin)
 - extern
 - proxycache
 - proxyjobs
 - proxyoutput
 - smart
 - CCB-Germany
 - smart
 - vulnerability_10
 - vulnerability_10
- Search Results

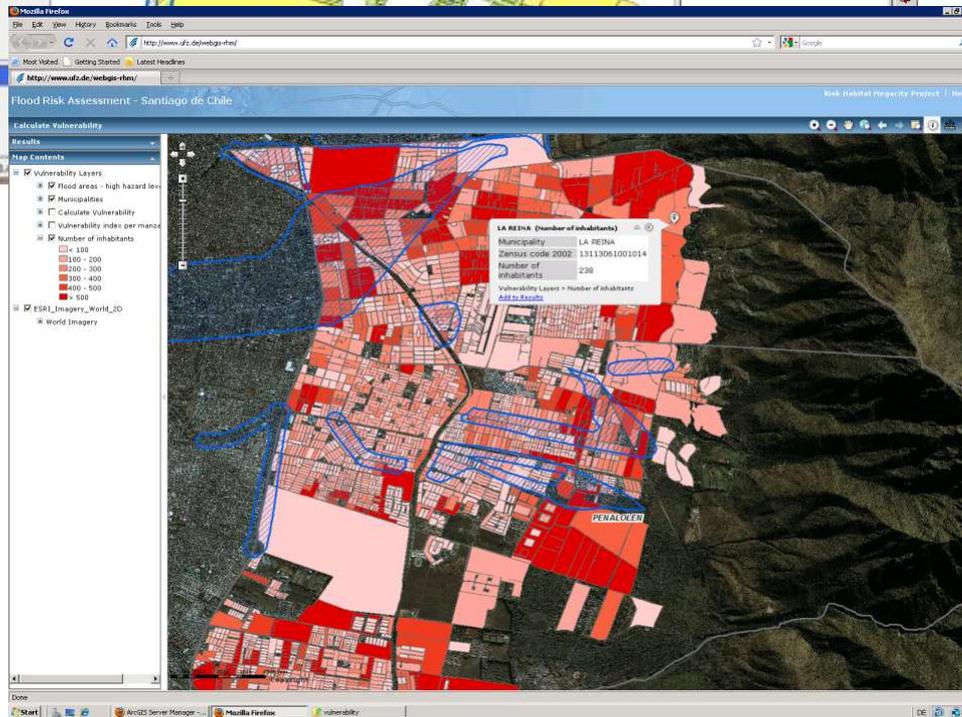
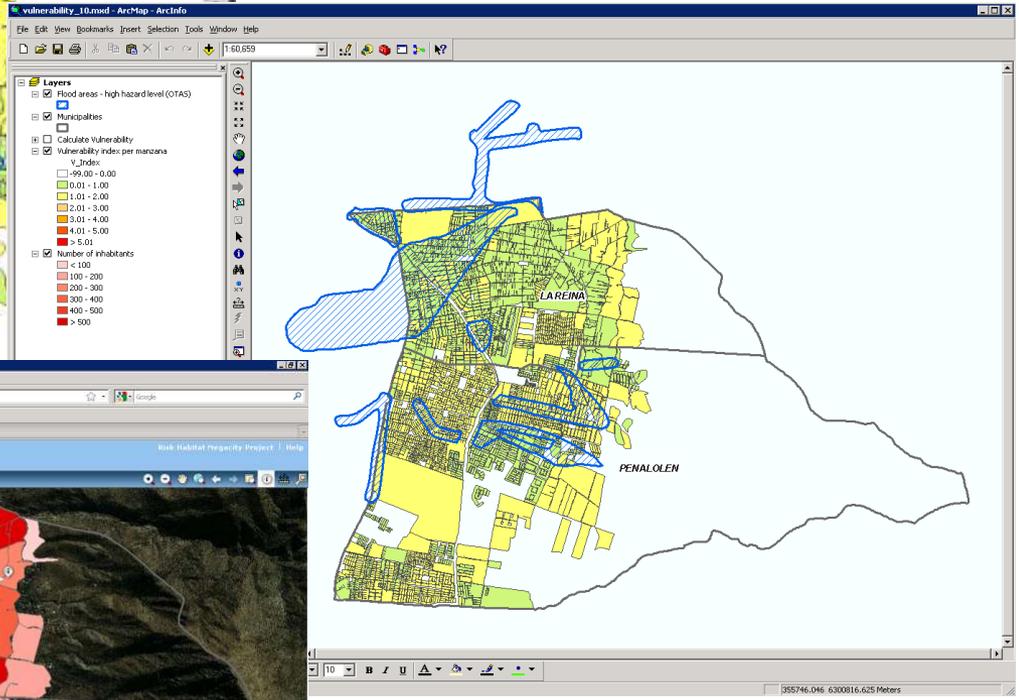
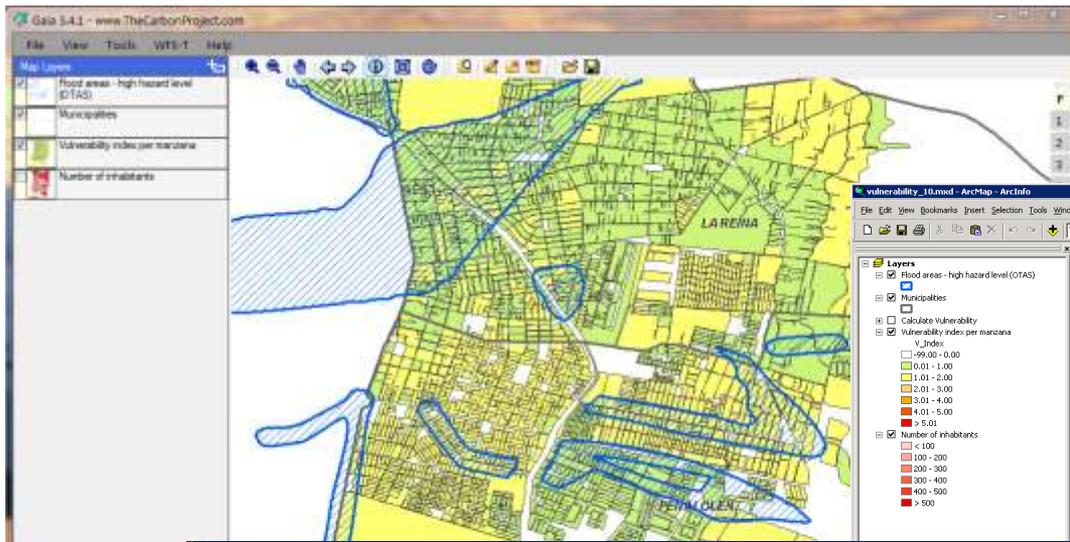
Contents Preview Metadata

Name	Type	Status	Startup	In
extern	ArcGIS Server Folder			
proxycache	ArcGIS Server Folder			
proxyjobs	ArcGIS Server Folder			
proxyoutput	ArcGIS Server Folder			
smart	ArcGIS Server Folder			
CCB-Germany	Map Service	Started	Automatic	1
smart	Map Service	Started	Automatic	1
vulnerability_10	Geoprocessing Service	Started	Automatic	1
vulnerability_10	Map Service	Started	Automatic	1

ArcGIS Server ufzgis selected



+ Use





**+ Erzeugung
einer Web-
anwendung**

- Home
- Services
- Applications**
 - Web Applications**
 - Mobile Projects
 - KML Network Links
 - OGC Services
 - Settings
- GIS Server
- Security

Editing webgis-rhm

- General**
- Layers
- Tasks
- Map Elements
- Page Properties
- Application Settings
- Summary

Specify the name of the application you want to create.

Name:

Description:

[Advanced Options](#)

- [Next >](#)
- [Finish](#)
- [Cancel](#)

GIS Server Status

Name: ufzgis
Status: **Online**
Started: 3/19/2010 6:35 AM
Messages: [View](#)

- Home
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Choose the layers to display in the web application.

Add Layer | Remove Layer

Current Layers:

- Vulnerability Layers
 - Flood areas - high haze
 - Municipalities
 - Calculate Vulnerability
 - Vulnerability index per
 - Number of inhabitants
- ESRI_Imagery_World_2D
 - World Imagery

Layer Properties:

Map Display:

Use coordinate system of: (default)

Set the initial extent to: Default Extent Custom Extent

- < Previous
- Next >
- Finish
- Cancel

Home

Services

Applications

Web Applications

- Mobile Projects
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GIS Server

Security

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Editing webgis-rhm

- General
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Choose the tasks to include in the web application. Some tasks may require supporting GIS services in order to execute.

Add Task | Remove Task | Supporting Services

Calculate Vulnerability

-
-
-
-
-
-

[Configure...](#)

- [< Previous](#)
- [Next >](#)
- [Finish](#)
- [Cancel](#)

Home

Services

Applications

Web Applications

- Mobile Projects
- KML Network Links
- OGC Services
- Settings

GIS Server

Security

Editing webgis-rhm

- General
- Layers
- Tasks
- Map Elements**
- Page Properties
- Application Settings
- Summary

Select the map elements to include in the web application.

- Table of Contents
- Overview Map
- Toolbar
- Navigation
- Scale Bar
- Zoom Level
- Map Copyright Text

Properties:

The Table of Contents shows the layers being displayed. Set the display characteristics of the Table of Contents.

- Allow layers to be turned on and off

Show layer symbology

Yes

No

- Roads
 - Public Roads
 - State Route
- Landuse
 - Agriculture

- Roads
 - Public Roads
 - State Route
- Landuse
 - Agriculture

- < Previous
- Next >
- Finish
- Cancel

GIS Server Status

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- Home
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Editing webgis-rhm

- General
- Layers
- Tasks
- Map Elements
- Page Properties**
- Application Settings
- Summary

Select the properties to apply to the web page.

Title text:

Theme:



Click to change theme

Web page links:

Name	URL	
Risk Habitat Megacity Project	http://www.risk-habitat-megacity.ufz.de/	
Help		
<input type="text" value="Link text"/>	<input type="text" value="Link URL"/>	
Add New Link		

GIS Server Status

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 Messages: [View](#)

- < Previous
- Next >
- Finish
- Cancel

- Home
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GIS Server Status

Name: ufzgis
Status: **Online**
Started: 3/19/2010 6:35 AM
Messages: [View](#)

Editing webgis-rhm

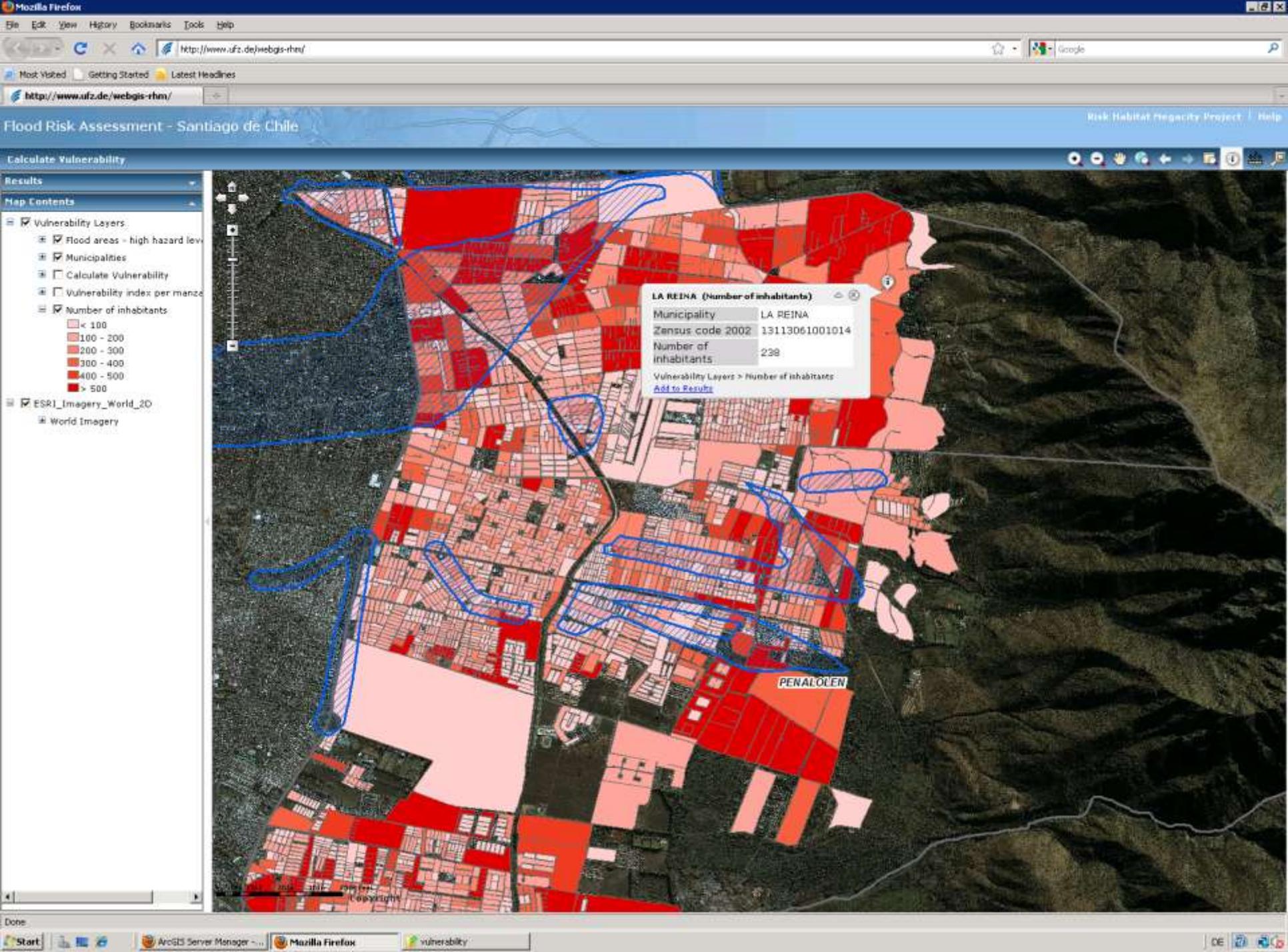
- General
- Layers
- Tasks
- Map Elements
- Page Properties
- Application Settings
- Summary**

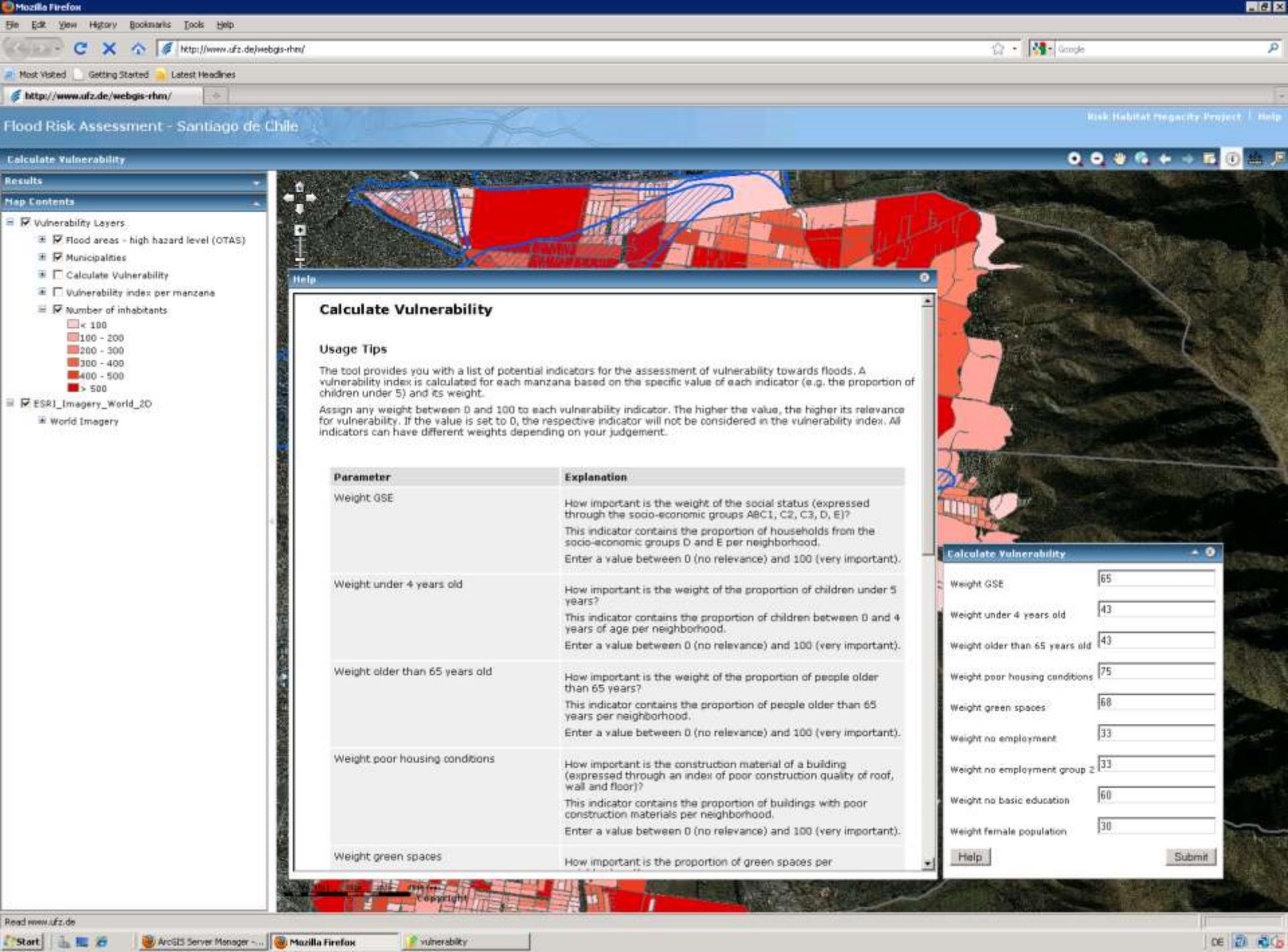
Click 'Finish' to complete the application configuration.

Host machine: ufzgis
Application name: webgis-rhm
URL: http://ufzgis/webgis-rhm/Default.aspx
Physical directory of application: C:\inetpub\wwwroot\webgis-rhm

View web application in a new browser window

< Previous **Finish** Cancel





Calculate Vulnerability

Results

Map Contents

- Vulnerability Layers
 - Flood areas - high hazard level (OTAS)
 - Municipalities
 - Calculate Vulnerability
 - Vulnerability index per manzana
 - Number of inhabitants
 - < 100
 - 100 - 200
 - 200 - 300
 - 300 - 400
 - 400 - 500
 - > 500
- ESRI_Imagery_World_2D
 - World Imagery

Calculate Vulnerability

Usage Tips

The tool provides you with a list of potential indicators for the assessment of vulnerability towards floods. A vulnerability index is calculated for each manzana based on the specific value of each indicator (e.g. the proportion of children under 5) and its weight.

Assign any weight between 0 and 100 to each vulnerability indicator. The higher the value, the higher its relevance for vulnerability. If the value is set to 0, the respective indicator will not be considered in the vulnerability index. All indicators can have different weights depending on your judgement.

Parameter	Explanation
Weight GSE	How important is the weight of the social status (expressed through the socio-economic groups ABC1, C2, C3, D, E)? This indicator contains the proportion of households from the socio-economic groups D and E per neighborhood. Enter a value between 0 (no relevance) and 100 (very important).
Weight under 4 years old	How important is the weight of the proportion of children under 5 years? This indicator contains the proportion of children between 0 and 4 years of age per neighborhood. Enter a value between 0 (no relevance) and 100 (very important).
Weight older than 65 years old	How important is the weight of the proportion of people older than 65 years? This indicator contains the proportion of people older than 65 years per neighborhood. Enter a value between 0 (no relevance) and 100 (very important).
Weight poor housing conditions	How important is the construction material of a building (expressed through an index of poor construction quality of roof, wall and floor)? This indicator contains the proportion of buildings with poor construction materials per neighborhood. Enter a value between 0 (no relevance) and 100 (very important).
Weight green spaces	How important is the proportion of green spaces per

Calculate Vulnerability

Weight GSE

Weight under 4 years old

Weight older than 65 years old

Weight poor housing conditions

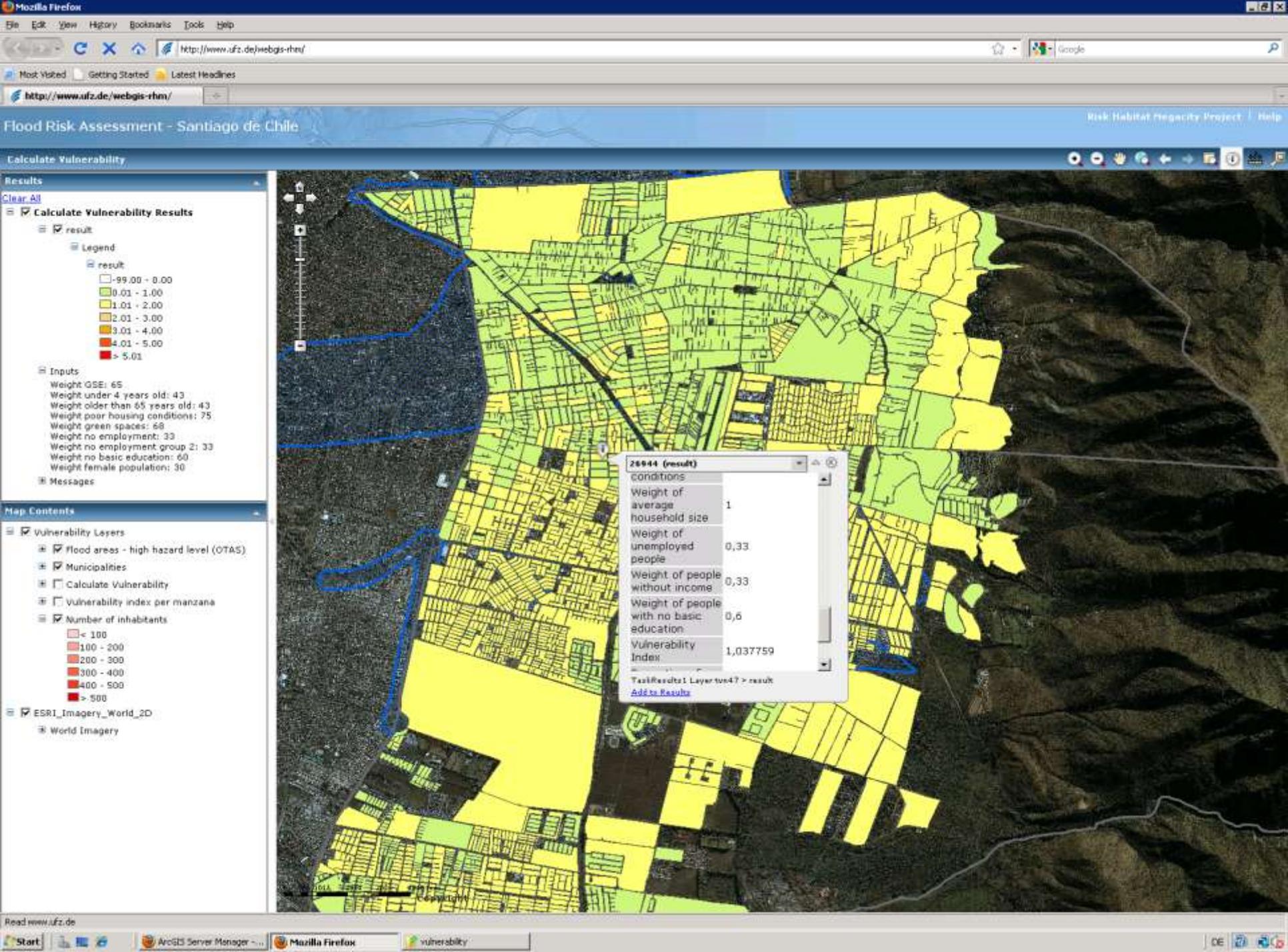
Weight green spaces

Weight no employment

Weight no employment group 2

Weight no basic education

Weight female population



Zusammenfassung/Diskussion I

- Webanwendung ermöglicht Interaktion & Beteiligung von Projektpartnern und Entscheidungsträgern vor Ort
- Einfache Kommunikation von Forschungsergebnissen
- Transparente Lösung des Problems der Gewichtung der Vulnerabilitätsindikatoren
- Ergebnisse stellen keine Planungsgrundlage dar, sondern nur Szenarien im Sinne eines Entscheidungsunterstützungssystems
- Ausbaufähig: kann z.B. zur Risikoanalyse komplettiert werden
- Zugangsschutz zu sensiblen Informationen muss gewährleistet sein

Zusammenfassung/Diskussion II

- Mit wenigen Mausklicks zu erstellen, anpassbar/dynamisch
- einfach bedienbarer Webklient
- Aufgrund der Dienstarchitektur in verschiedenen Klienten nutzbar
- Nutzung der Geoverarbeitungsdienste bislang via SOAP und REST, nicht via WPS
- WPS für ArcGIS Server wurde erfolgreich mit dem 52°north Framework getestet