"From the wisdom of the ages
to the challenges of modern world"

FIG WORKING WEEK 2015

17–21 MAY SOFIA BULGARIA

Organised by:

FIG

CHAMBER OF GRADUATED SURVEYORS

Platinum Sponsors:

Trimble.

esri

Developing Interoperable Geographic Data Model for the Mitigation Phase of Disaster Management

Assoc. Prof. Dr. Arif Cagdas AYDINOGLU

(Gebze Technical University, Dept. Of Geomatics Engineering, Turkey)

PhD Student Bekir TASTAN

(Istanbul Technical University, Institute of Informatics, Geographic Information Technologies Program, Turkey)

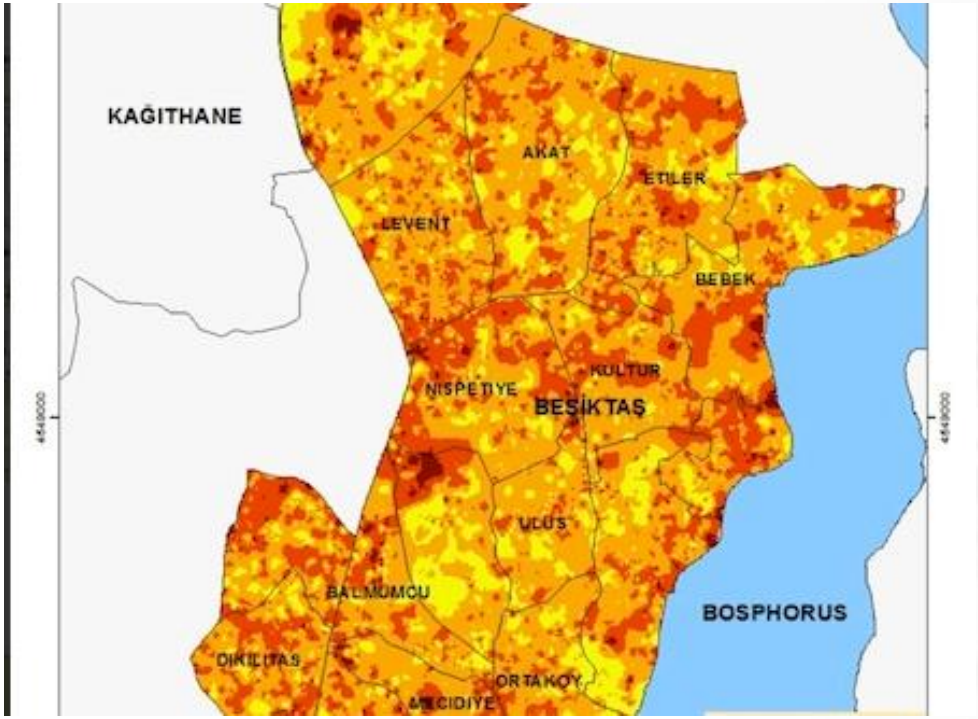
INTRODUCTION

Many people encounters with different types of disasters. These disasters cause huge destruction and loss of life.

Disaster management is to perform " preparedness, response, recovery, and mitigation phases of the disasters in a cycle.

Mitigation includes studies towards necessary technical, administrative and social measures.

INTRODUCTION



GIS based fire risk map (http://arifcagdas.com/)

In view of intricate character of disasters, GIS can deal with different geographic and real time data sets.

With various capabilities, different types of data for disaster management can be used collaboratively

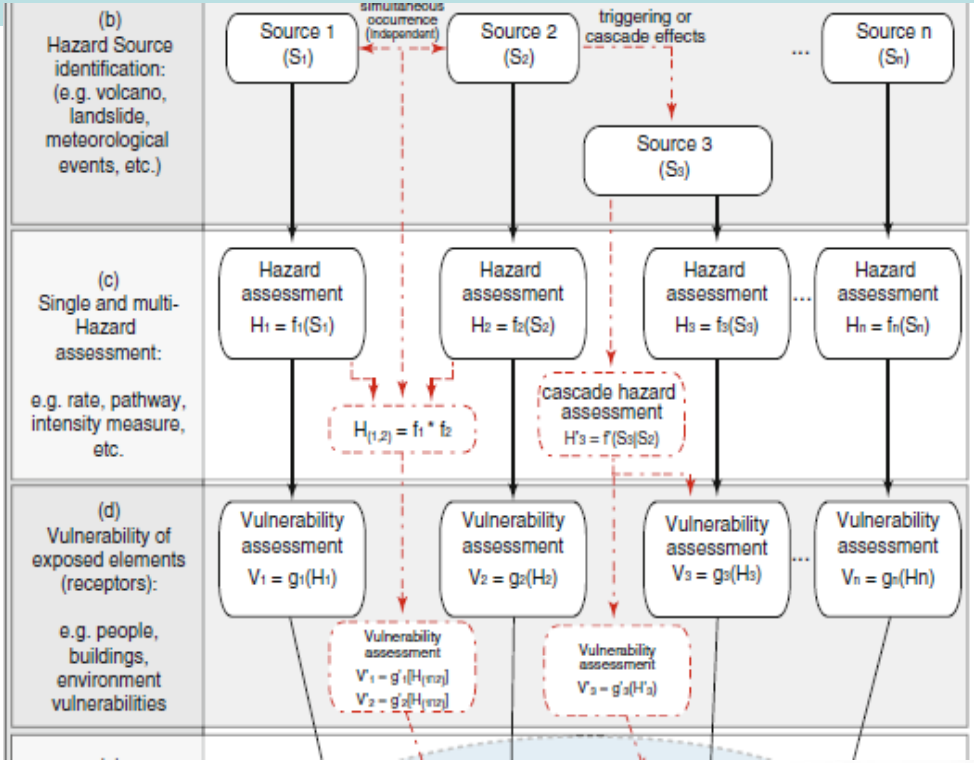
MULTI HAZARD DISASTER RISK

Japanese Earthquake and following Tsunami 2011

Multiple hazard situations are consisting of the initiation of a hazard and other events the result of the consecutive occurrence of hazards.

First event initiates following series of events. As example, in consecutive events, earthquake trigger landslide and tsunamis.

MULTI HAZARD DISASTER RISK

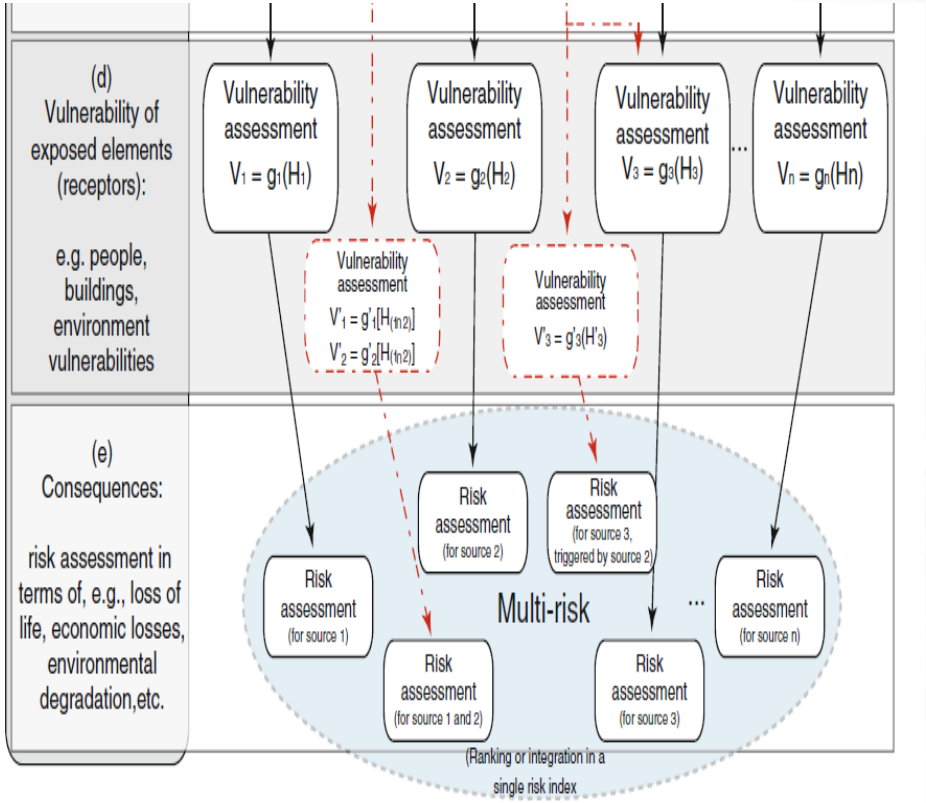


Multi risk assessment is a complex process. It begins with a step identifying the source of each trigger of fluctuation danger.

Next vulnerability analysis is made for assets, people buildings and environment exposed to hazards

Multi risk assessment stages (Marzocchi et al., 2012:557)

MULTI HAZARD DISASTER RISK



Risk assessment in terms of loss of life, economic losses and environmental degradation is performed for single hazard and triggered hazards.

Finally multi risk situation are ranked and integrated in a single risk index.

INTEROPERABLE GEOGRAPHIC DATA MODEL for DISASTER MANAGEMENT

ISO

TURKISH NATIONAL GEOGRAPHIC INFORMATION SYSTEMS

TUCBS
TÜRKİYE ULUSAL COĞRAFİ BİLGİ SİSTEMLERİ

T.C. ÇEVRE VE ŞEHİRCİLİK BAKANLIĞI
COĞRAFİ BİLGİ SİSTEMLERİ GENEL MÜDÜRLÜĞÜ

A geographic data model has been developing for disaster risk management

+ for the risk management of destructive disasters in Turkey such as flood, fire/urban fire, earthquake, and traffic accident.

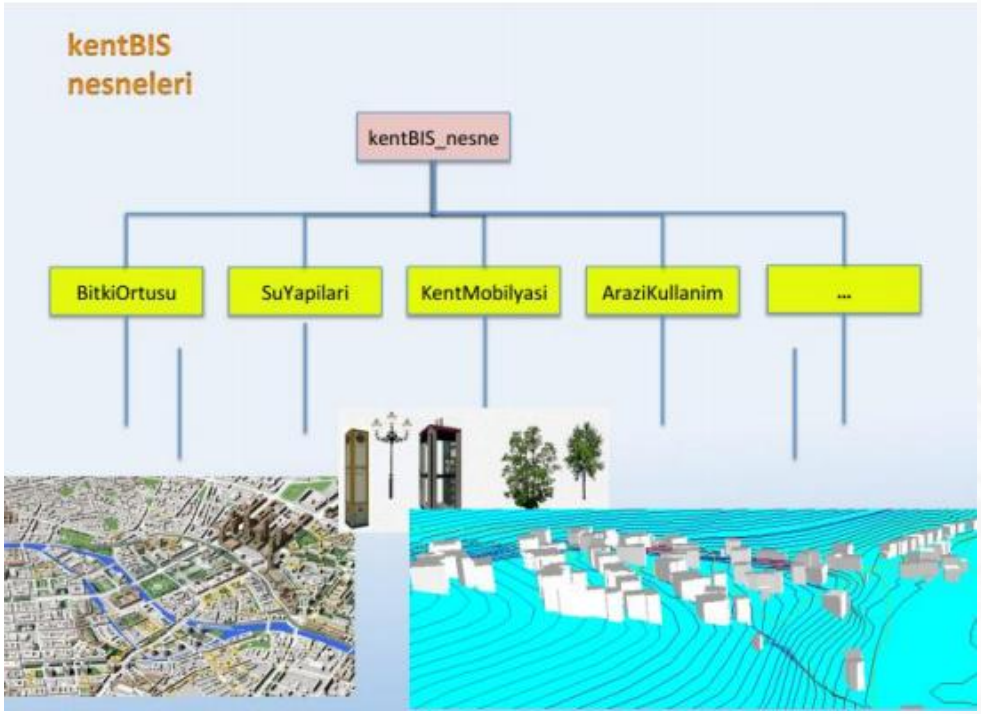
+ compatible with the standards of ISO TC/211 and Turkish National Geographic Information System (TUCBS).

TURKISH NATIONAL GEOGRAPHIC INFORMATION SYSTEMS (TRGIS)

TUCBS data models include UML applications schemas and feature catalogs for base data themes such as
Address (AD), Building (BI), Cadastre and Land Registry (TK), Administrative Unit (IB), Transportation (UL), Hydrography (HI), Land Cover/Use (AO), Orthophoto (OR), Topography (TO), and Geodesy (JD)

These are base required data for disaster management.

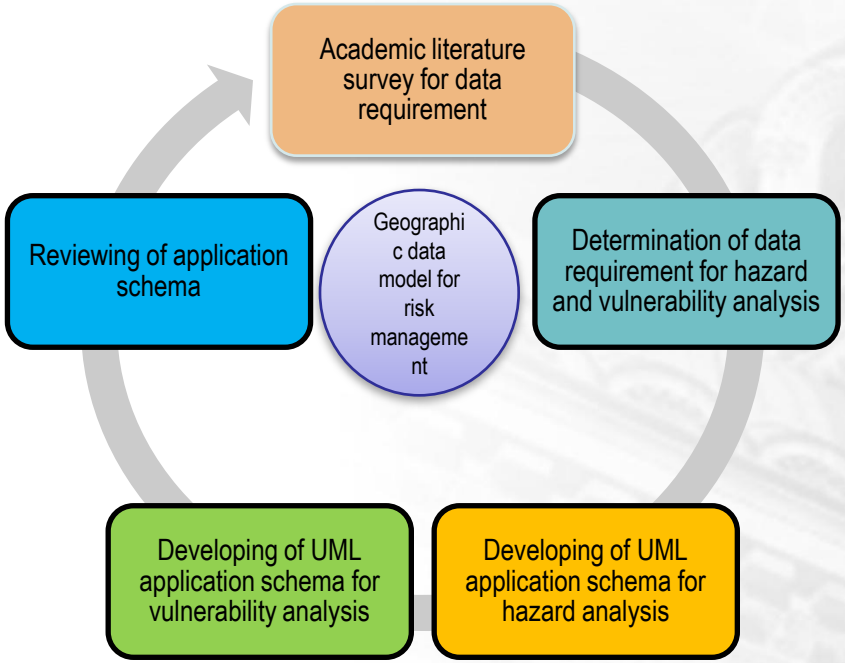
Turkish National GIS data themes (GDGIS, 2012 a)



Turkish City Information System (TCI-KBS) data themes

Besides, Urban GIS data model supporting urban management was used,
includes data models for data themes such as Vegetation (BO), Public Services (KH), Urban Furniture(KM), and Water mass (SK) (GDGIS, 2012b).

Development Stages of Geographic Data Model

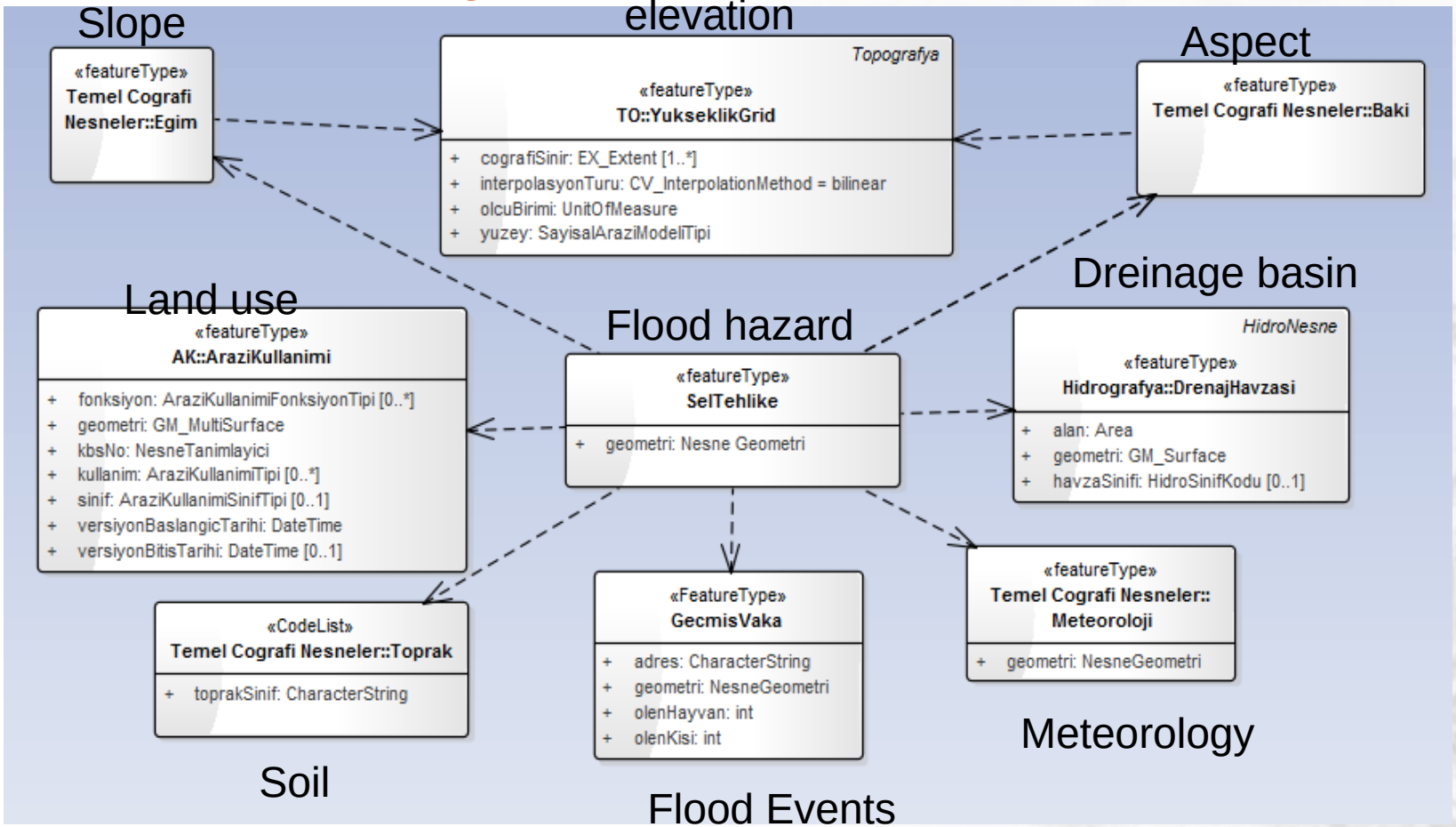


Data requirement analysis for hazard analysis	• Fire/Urban fire • Traffic accident • Earthquake, • Flood, • Landslide
Data requirement analysis for vulnerability analysis	• Physical vulnerability (Building, infrastructure, transportation, • telecommunication network, pipeline) • Social and economical vulnerability (Building social and economical vulnerability; sex, • education, age, population distribution, The number of households
Developing of UML application schema for hazard analysis	• Fire/Urban fire • Traffic accident • Earthquake, • Flood, • Landslide
Developing of UML application schema for vulnerability analysis	• Fire/Urban fire; physical, social and economical, environmental vulnerability and coping capacity application schema • Traffic accident physical,;social and economical, environmental vulnerability and coping capacity application schema • Earthquake; physical, social and economical, environmental vulnerability and coping capacity application schema • Flood; physical, social and economical, environmental vulnerability and coping capacity application schema • Landslide; physical, social and economical, environmental vulnerability and coping capacity application schema

Geographic Data Model for Hazard Analysis

- For flood hazard analysis; aspect (*Baki*) and slope (*Egim*) feature types obtained from elevation feature type (*YukseklikGrid*) of TUCBS TO, land use (*AraziKullanimi*) featuretype from TUCBS AO, drainage basin(*DrenajHavzasi*) featuretype from TUCBS HI, soil groups and meteorological feature types from other base themes (*TemelCografiNesneler*), and flood events data sets (*GecmisVaka*) should be used to produce flood hazard feature type (*SelTehlike*). All attributes, values, and relationships were defined with ISO/TC211 encoding rules as defined in the schema.

For flood hazard analysis



- For forest fire hazard analysis (*OrmanYanginiTehlike*); aspect (*Baki*), slope (*Egim*), and elevation (*YukseklikGrid*) feature types from TUCBS TO, land use feature type (*AraziKullanimi*) from KBS AK, road feature type from TUCBS UL, district (*Mahalle*) feature type from TUCBS ID, vegetation feature type from TUCBS BO, meteorological and inventory feature types from base themes (*TemelCografiNesneler*), and fire events data set (*GecmisVaka*) should be used to produce flood hazard feature type (*OrmanYanginiTehlike*) with defined content on the schema.

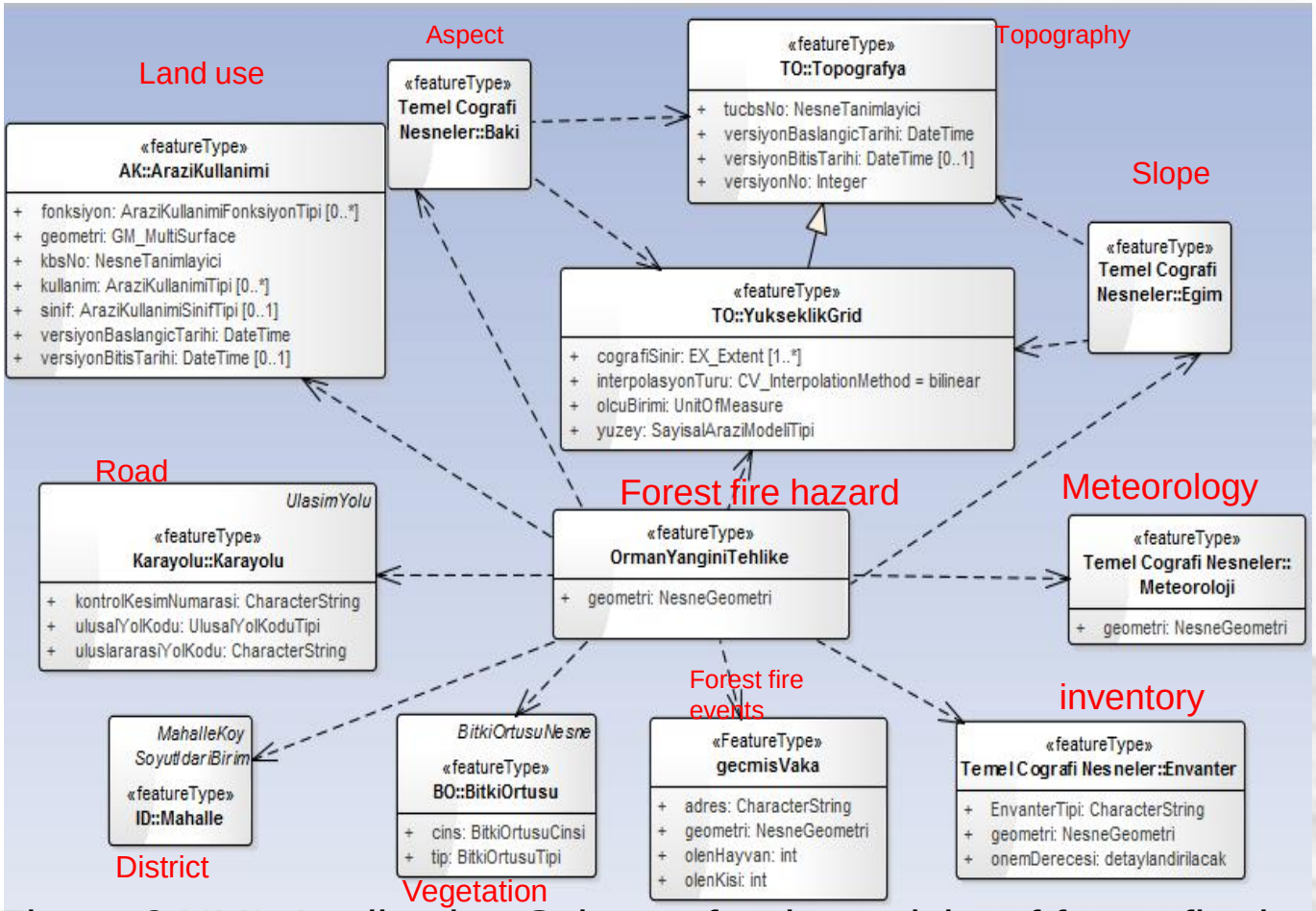


Figure 2.UML Application Schema for the activity of forest fire hazard analysis

Geographic Data Model for Vulnerability Analysis

- For vulnerability analysis of all disaster types; buildings, infrastructures, and transportation feature types were accepted as vulnerable elements. Data contents were defined also for environmental, economic and social vulnerability.
- For fire vulnerability analysis as example; infrastructure (*Altyapi*), transportation (*Ulasim*), and fire building (*YanginZararBina*) feature types are required. Infrastructure includes telecommunication network (*TelekomunikasyonAgi*), energy pipeline (*EnergyNakilHatti*), sewer pipeline (*KanalizasyonBorusu*), and pipeline (*BoruHatti*).

- Transportation includes road (*Karayolu*), railroad (*Demiryolu*), seaway (*DenizyoluHatti*), and air lines (*UcusHatti*). Besides, data content was defined to determine social (SosyalZarargorebilirlik), economic (EkonomikZarargorebilirlik), and environmental (*CevreselZarargorebilirlik*) vulnerability.

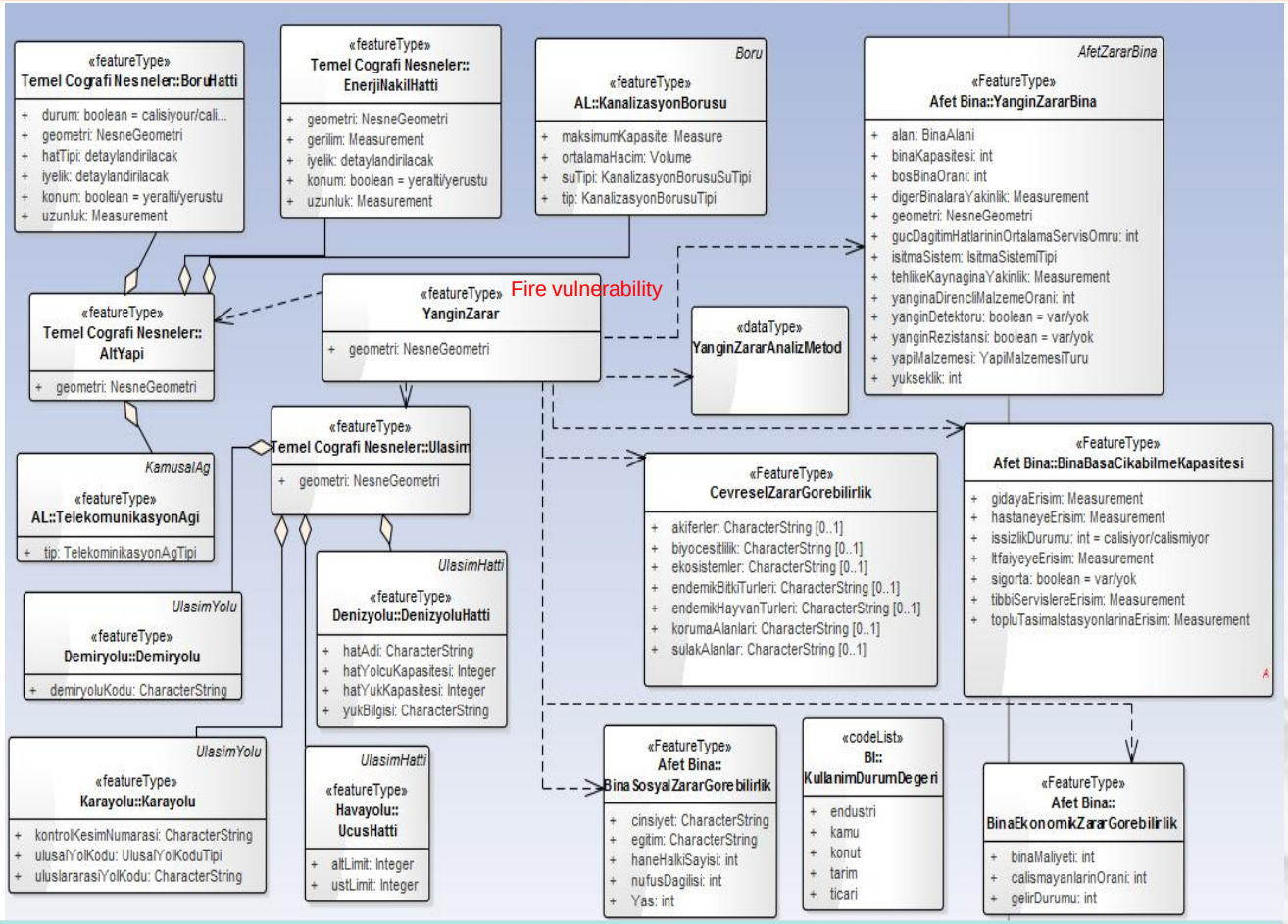


Figure 3. UML Application Schema for the activity of fire vulnerability analysis

CONCLUSION

- Considering the complex nature of disaster risk management, this model can be used as base data exchange model to produce hazard and vulnerability maps that determine risk map.
- Open data model is compatible with national geographic data standards of Turkey to support data interoperability between actors.

Thank you for your participation.

REFERENCES

- GD-GIS, 2012a.TRGIS Policy, Ministry of Environment and Urbanization, Gen. Directorate of GIS, Project Report, Ankara.
- GD-GIS, 2012b. TRGIS Conceptual Model Components, Ministry of Environment and Urbanization, Gen. Directorate of GIS, Implementation Rules, Ankara.
- Komendantova, N., Mrzyglocki, R., Mignan, A., Khazai, B., Wenzel, F., Patt, A., & Fleming, K. (2013).New Multi-Hazard and Multi-Risk Assessment Methods for Europe and man-induced risks. European Commission Directorate General for Research. Brussels.
- http://bdohingalganj.org/index.php/disaster-management
- http://edition.cnn.com/search/?text=NEPAL+EARTHQUAKE
- http://arifcagdas.com/