**Site selection**

**Satellite image analysis**

**Stages**

**Description**

**Steps**

**Partition**

Field Survey and Various Photographic Analysis

Factors selection

-DEM (slope aspect, TWI, curvature)

-Forest, Soil, Geology, Land-use

**Used PCI for pix file**

Applied models

-Fuzzy set

-Bayesian

-Likelihood ratio

Cross validation

**Susceptibility map**

Success-rate curve evaluation for each model

**Model application**

**Socio-economic data**

**Risk Assessment**

Added Monetary value US$ and vulnerability scale

Life, Agriculture and Infrastructural risk by SRA

Landslide inventory preparation using GIS

**Figure 2**. Methodology flowchart for the research

Table 1. Relationship between occurred landslides and causative factors.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Factors** | **Classification** | **Total pixels number** | **% of total pixels** | **Landslide pixels number** | **% of Landslide pixels** | **FR** |
| Slope  (degree) | 0–5 | 703,700 | 11.99 | 0 | 0 | 0 |
| 5–10 | 400,712 | 6.83 | 0 | 0 | 0 |
| 10–15 | 456,708 | 7.78 | 0 | 0 | 0 |
| 15–20 | 538,833 | 9.18 | 149 | 2.90 | 0.32 |
| 20–25 | 728,889 | 12.42 | 581 | 11.31 | 0.91 |
| 25–30 | 986,511 | 16.81 | 1,072 | 20.87 | 1.24 |
| 30–35 | 1,029,727 | 17.54 | 1,478 | 28.77 | 1.64 |
| 35–40 | 678,031 | 11.55 | 1,375 | 26.77 | 2.32 |
| 40–45 | 262,823 | 4.48 | 344 | 6.70 | 1.50 |
| >45 | 84,347 | 1.44 | 138 | 2.69 | 1.87 |
| Aspect | Flat | 390,104 | 6.65 | 0 | 0 | 0 |
| North | 761,881 | 12.98 | 253 | 4.93 | 0.38 |
| Northeast | 699,942 | 11.92 | 340 | 6.62 | 0.56 |
| East | 666,509 | 11.35 | 479 | 9.32 | 0.82 |
| Southeast | 639,603 | 10.90 | 605 | 11.78 | 1.08 |
| South | 626,024 | 10.66 | 834 | 16.24 | 1.52 |
| Southwest | 661,129 | 11.26 | 1,252 | 24.37 | 2.16 |
| West | 703,734 | 11.99 | 1,055 | 20.54 | 1.71 |
| Northwest | 721,355 | 12.29 | 319 | 6.21 | 0.51 |
| Curvature  (+ to –) | –96.4 to –14.20 | 43,628 | 0.74 | 73 | 1.42 | 1.92 |
| –14.20 to –6.32 | 216,399 | 3.69 | 518 | 10.08 | 2.73 |
| –6.32 to –1.94 | 664,561 | 11.32 | 1,535 | 29.88 | 2.64 |
| –1.94 to 0.68 | 3,265,101 | 55.62 | 1,825 | 35.53 | 0.64 |
| 0.68–5.06 | 1,333,300 | 22.71 | 899 | 17.50 | 0.77 |
| 5.06–12.94 | 291,460 | 4.97 | 226 | 4.40 | 0.89 |
| 12.94–127.59 | 55,832 | 0.95 | 61 | 1.19 | 1.25 |
| Topographic wetness index (+ to –) | –1 to 2.31 | 1,927,790 | 32.84 | 2,402 | 46.76 | 1.42 |
| 2.31–3.96 | 2,325,941 | 39.62 | 2,262 | 44.03 | 1.11 |
| 3.96–6.52 | 1,073,064 | 18.28 | 453 | 8.82 | 0.48 |
| 6.52–10.48 | 472,267 | 8.05 | 20 | 0.39 | 0.05 |
| 10.48–20.13 | 71,219 | 1.21 | 0 | 0 | 0 |
| Geology | Felsite | 3080 | 0.05 | 0 | 0 | 0 |
| Choseon | 240,729 | 4.10 | 200 | 3.89 | 0.95 |
| Gneiss | 11,076 | 0.19 | 0 | 0 | 0 |
| Pleistocene | 1,834,861 | 31.26 | 712 | 13.86 | 0.44 |
| Alluvium | 380,534 | 6.48 | 0 | 0 | 0 |
| Granite | 3,400,001 | 57.92 | 4,225 | 82.25 | 1.42 |

Table 1. continued

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Factors** | **Classification** | **Total pixels number** | **% of total pixels** | **Landslide pixels number** | **% of Landslide pixels** | **FR** |
| Land-use | Cropland | 998,232 | 17.00 | 117 | 2.28 | 0.13 |
| River | 18,068 | 0.31 | 0 | 0 | 0 |
| Marsh | 92,537 | 1.58 | 0 | 0 | 0 |
| Dry land | 92,565 | 1.58 | 0 | 0 | 0 |
| Wetland | 28,420 | 0.48 | 0 | 0 | 0 |
| Grassland | 67,696 | 1.15 | 256 | 4.98 | 4.33 |
| Natural Forest | 32,586 | 0.56 | 27 | 0.53 | 0.95 |
| Natural Grass | 50,884 | 0.87 | 141 | 2.74 | 3.15 |
| Coniferous | 1,746,355 | 29.75 | 2,180 | 42.44 | 1.43 |
| Mixed forest | 291,953 | 4.97 | 178 | 3.47 | 0.70 |
| Deciduous | 2,450,985 | 41.75 | 2,240 | 43.61 | 1.04 |
| Forest  type | Forest free area | 1,109,536 | 18.90 | 0 | 0 | 0 |
| Pine | 1,301,653 | 22.17 | 2,249 | 43.78 | 1.97 |
| Deciduous | 1,575,363 | 26.84 | 490 | 9.54 | 0.36 |
| Bare land | 98,243 | 1.67 | 0 | 0 | 0 |
| Pasture | 20,998 | 0.35 | 0 | 0 | 0 |
| Mixed | 920,775 | 15.69 | 566 | 11.02 | 0.70 |
| Riparian | 6,291 | 0.11 | 0 | 0 | 0 |
| Coniferous | 3,320 | 0.06 | 0 | 0 | 0 |
| Planted pine | 1,819 | 0.03 | 0 | 0 | 0 |
| Hardwood | 7,577 | 0.13 | 0 | 0 | 0 |
| Nut pine | 310,195 | 5.28 | 909 | 17.70 | 3.35 |
| Broad leaf | 506,095 | 8.62 | 923 | 17.97 | 2.08 |
| Rigida pine | 1,066 | 0.02 | 0 | 0 | 0 |
| Oak | 7,350 | 0.13 | 0 | 0 | 0 |
| Forest  crown  density | Forest free area | 1,279,391 | 21.79 | 0 | 0 | 0 |
| Loose | 37,291 | 0.64 | 113 | 2.20 | 3.44 |
| Moderate | 1,905,371 | 32.46 | 1,985 | 38.64 | 1.19 |
| Dense | 2,648,228 | 45.11 | 3,039 | 59.16 | 1.31 |
| Soil  drainage | Water | 99,545 | 1.70 | 0 | 0 | 0 |
| Well drained | 2,314,981 | 39.44 | 1,104 | 21.49 | 0.54 |
| Drained | 3,243,164 | 41.56 | 4,006 | 77.98 | 1.41 |
| Poorly | 208,104 | 55.25 | 27 | 0.53 | 0.15 |
| Defective | 4,487 | 0.08 | 0 | 0 | 0 |
| Soil  texture | Water | 99,545 | 1.70 | 0 | 0 | 0 |
| Coarse | 4,696,991 | 80.01 | 4,969 | 96.73 | 1.21 |
| Fine loam | 928,639 | 15.82 | 155 | 3.02 | 0.19 |
| Clay | 78,203 | 1.33 | 0 | 0 | 0 |
| Sandy | 66,903 | 1.14 | 13 | 0.25 | 0.22 |
| Total number of study area pixels: 5870281 and affected pixels: 5,137 | | | | | | |