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# Preservation Tension in Road-Corridor Landscapes: A Tabular PPGIS Analysis of Dutch Participatory Mapping Evidence

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## Abstract

Planners of road corridors are thus confronted with the problem of how to translate capacity considerations into action within the context of valued landscapes that have been recognized as such by the local population. Public Participatory Geographic Information Systems (PPGIS) can be used to identify these valued places. However, a survey of preferences does not necessarily yield information about the interpretation of weakly separated preservation options. In this paper, we apply the technique of Co-Valuation Tension Graphing to the question of how aggregate PPGIS data indicate preservation-stability, ambiguity-sensitivity, negotiation, and dependency on corridor planning as conditions for road-infrastructure development. Empirically, there are 1044 participants and 3132 mapped valued landscapes of Dutch corridor planning involving 1734 points, 1120 polygons, and 278 lines. The study applies sustainability-value coupling, land use selection, co-land use, and preservation-point concentration measures. The findings demonstrate that the public preference pattern is structured even if there is no preference for a unique sacrifice hierarchy. Company settlement and development potential show the strongest value coupling ($r_s = 0.596$). Water body and soil represent the strongest substrate for environmental preservation ($r_s = 0.492$). Agricultural land represents the most planning sensitive use because it shows positive relationships with ecology and biodiversity, soil, water bodies, and spatial quality and negative relationships with accessibility, development potential, citizen settlement, well-being and health, and social relevance. There is only very weak value selection of roads by preference scores but the land use adjacent to road infrastructure represents business, semi-built up, agricultural, and railway terrain. Preservation-point values demonstrate the extent of choice compression with 39.5% of respondents scoring above 50, 23.8% above 60, and 13.7% above 70 points. PPGIS tables may inform corridor planning if interpreted as relational evidence of value coupling, land use sensitivity, and preservation compression.

**Keywords:** Public Participatory GIS; road infrastructure planning; landscape values; land-use selectivity; preservation compression; spatial decision support

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## 1. Introduction

The road corridor is not only an engineering challenge; it is a territorial decision task where residents can benefit from improved accessibility, connection between employment areas, and movement of regional significance. But at the same time, the construction of a new or alteration of an existing road corridor may affect valued agricultural lands, natural combination of land uses, urban-rural borders, and places that are important for local communities. The main difficulty of the planning task consists in obtaining preferences and understanding their meaning when several valued places are involved in the public preference, and when residents refuse to choose what place should be preserved for the sake of another one.

PPGIS has gained particular importance since it allows residents to delineate valued places directly on maps in addition to answering questions about institutions. Existing research demonstrates that the participatory mapping approach has the potential to link landscape values, place attachment, environmental quality, and land use [2–4, 18]. However, the value of PPGIS goes beyond the mapped point, line, or polygon. It becomes especially evident in demonstrating how meanings are associated with daily-use landscapes, even those that might look ordinary in formal land use descriptions. Thus, a field can serve both as productive land, an open landscape, water retention surface, and ecological buffer zone. A road border is also multi-functional, reflecting its roles in terms of mobility assets, development opportunities, and intrusiveness to neighboring valuable land areas.

The key question addressed by the analysis is whether PPGIS tabulated data allow identifying conditions of preservation tensions in cases when preferences of residents distribute along several valued places and not concentrated on a single location. The analysis focuses on the transition stage between PPGIS-based public preferences and planning decisions. It does not substitute route planning, environmental impact analysis, or the engineer's design responsibility. Using Co-Valuation Tension Graphing technique, this paper aims to interpret the PPGIS evidence as a planning signal.

Numerical data allow making this type of diagnosis due to the presence of four components, namely, the size and geometry of public input, the correlation between sustainability values, the correlation between sustainability values and land use, and preservation point distribution. These pieces of information help differentiate between the following situations that are usually mixed in corridor planning. First, a valued landscape might be strongly protected because of clear environmental signals. Second, a landscape might be negotiable if development and settlement values prevail. Third, a place might require careful treatment since land use bears complex meanings and residents hesitate to form any hierarchy of sacrifices.

Thus, the contribution of this paper is a more sophisticated use of Co-Valuation Tension Graphing technique within the framework of a specific corridor planning project. The procedure considers public-value coupling, land use selectivity, correlation in the presence of a road corridor, and preservation point compression without creating an additional analysis layer. As the main empirical finding, the manuscript identifies agricultural territory as a potential source of hidden preservation tensions due to its positive correlation with sustainability values, as well as low separation from other valued places.

## 2. Participatory Spatial Data in Corridor Planning

The literature on participatory mapping emphasizes that spatial information does not have purely objective character. The methods of participatory geographic information systems (PGIS) and participatory GIS (PGIS) have been designed to enhance public participation in spatial decisions and undermine cases when only technical maps drive planning conclusions [8, 19]. While recognizing practical and experiential nature of resident knowledge, researchers also warn about different ways in which spatial public data might depend on scales, access to technology, representation, and institutions involved in decision making [3, 5, 9].

Landscape-value mapping has become an operational approach allowing people to locate valued places rather than select options from the offered list. Several previous studies have demonstrated that values might be attached to land use categories, though they are not one-to-one [2, 4]. In other words, a mapped location can bear several values simultaneously. They can be related to ecology, scenery, recreation, cultural or personal attachment to landscape elements. For corridor planning, it means that it is impossible to infer the public value from land use alone. Agricultural land can carry ecological value, while built surfaces are characterized by social dimensions in addition to negative environmental value.

Governance literature adds an important consideration. While enhancing legitimacy and decision quality, participation becomes valuable only if it links resident knowledge and planning choices. According to communicative and collaborative planning traditions, resident knowledge becomes valuable precisely due to its role in option generation and negotiation [12, 28]. Moreover, critical literature notes that asking citizens to solve hard problems shifts the responsibility of decision-making process to the public if it is poorly organized [7]. Road planning should be performed responsibly by interpreting public knowledge without implying its ultimate power over the decision process.

The infrastructure literature supports this claim. The practice of motorways and road-infrastructure planning in the Netherlands evolved from line-oriented planning to the area-based planning involving connections of infrastructure with land use, spatial development, and landscape quality [6, 13, 14]. Planning-support literature also encourages generating the knowledge through dialogue with residents rather than transferring technical outputs to planning procedures [24, 25]. These findings are particularly valuable for PPGIS since a road corridor is not a line per se but a spatial element with its relations with agricultural lands, forests, water bodies, residential areas, business territories, and multimodal landscapes.

Another issue relates to choice compression. Spatial decision-making processes usually presuppose a clear ranking of preferences; however, in multi-value planning scenarios and under bounded rationality, such choice seems problematic [21, 23]. Landscape approach literature suggests that agriculture, conservation, development, and human well-being usually co-exist on the same territory [22, 26, 29]. Thus, when several valued places are involved, it may reflect lack of differentiation rather than of concern about public value.

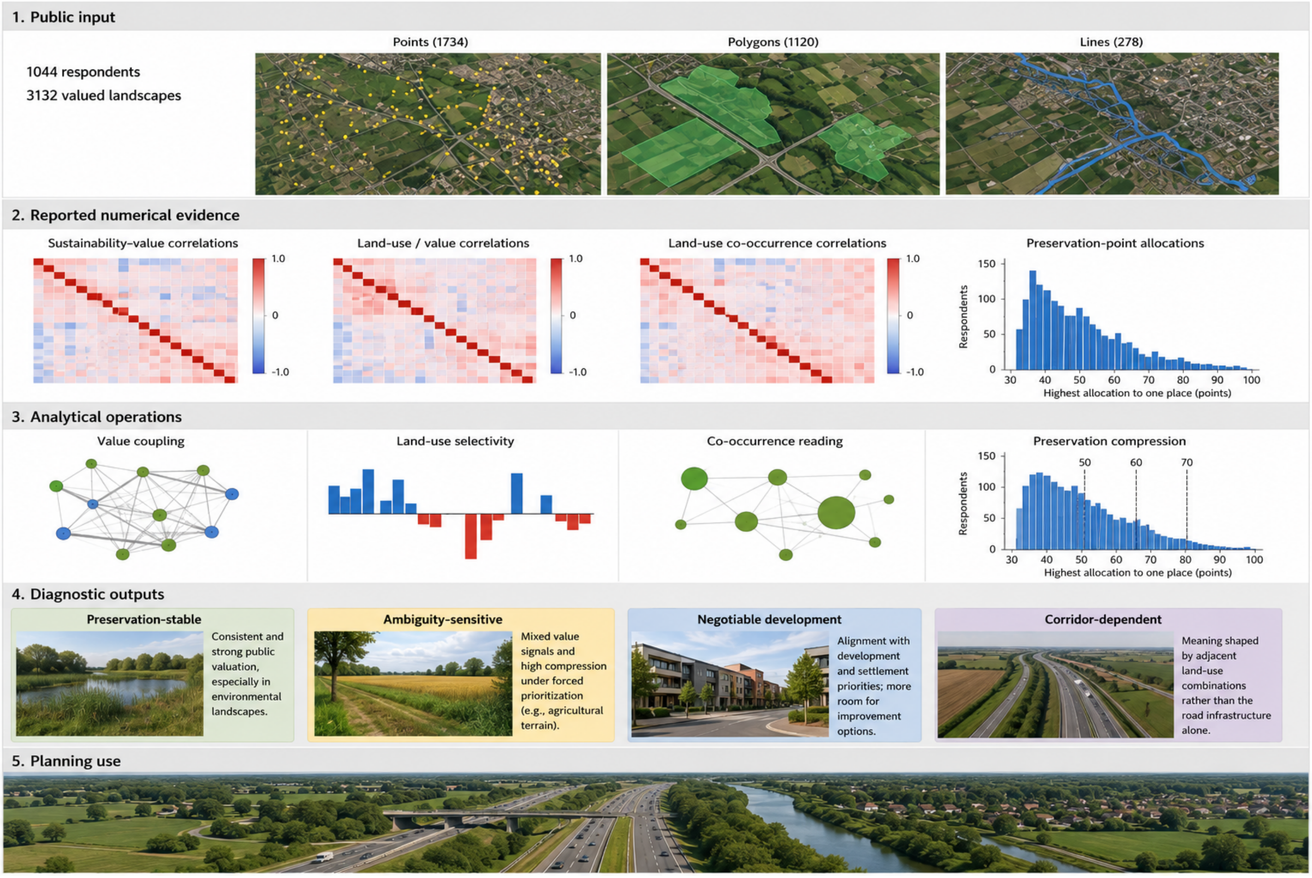
These aspects define an interpretive stance of the paper. Participatory spatial data should not be seen either as raw public opinion or as an automatic decision tool. Its value lies in describing the relationships between value and land use in the presence of spatial context, including the proximity to corridor infrastructure. The analysis below interprets aggregated PPGIS data in Dutch corridor planning as a sign of preservation tension.

## 3. Materials and Methods of Analysis

The numerical material involves tabulated data on landscape preferences received through Dutch PPGIS survey related to road planning and preservation values. The sample of the survey includes 1044 respondents, each of whom has provided 3132 valued landscapes. The total number of points, polygons, and lines is 1734, 1120, and 278, respectively. The ratio of these geometries is valuable since residents did not limit their valuation preferences to point location. They were interested in entire landscapes and linear elements, similar to the role of roads.

The numerical data comprise four groups. The first group is devoted to the number of participants and geometric distribution of mapped places. The second group represents the results of calculation of correlations of twelve sustainability values (Spearman). The third group includes Pearson correlations between eleven land-use categories and sustainability values. Finally, the last group presents land-use correlations, the correlation between preservation of valued places, and preservation points allocated by respondents to the first three valued places ([15]). The described numerical material allows evaluating a set of relations between land use, valued places, and preservation tension.

Figure 1 illustrates the pathway followed in this analysis from mapped values to planning classes. Public inputs are first understood as mapped landscapes and then represented as relations of values and land use and analyzed in the context of corridor planning classes. This sequence of analysis ensures that no single value, place, or coefficient dominates the interpretation. At the same time, it allows linking the interpretation with the actual data available in tabulation.



Consistent and strong public valuation, especially in environmental landscapes.

Mixed value signals and high compression under forced prioritization (e.g., agricultural terrain).

Alignment with development and settlement priorities; more room for improvement options.

Meaning shaped by adjacent land-use combinations rather than the road infrastructure alone.

**Figure 1.** Analytical pathway from mapped landscape values to corridor-planning classes.

## 3.1. Public Mapped Geometries and Corridor-Relevant Variables

The number of respondents and geometries defines the analytical starting point of the study. Each of them provided 3132 valued places using points, polygons, and lines. Thus, the total number of mapped places is sufficiently large while geometry ratios indicate that residents were interested in not only isolated points. Polygons demonstrate that the landscape surfaces also mattered for public valuation. Lines also demonstrate that some parts were important not only for landscape elements but also for corridors, movements, or boundaries between territories.

Land use is the next step of the analysis since it helps identify a subset of valued landscapes. There are 11 land-use categories: agriculture, forest, nature reserve, residential, commercial, mixed residential-commercial, green area, recreational space, transportation space, water body, and industrial area. Agriculture, forest, and nature reserve together represent 85.5% of all public valuations, but residential and mixed residential-commercial categories occupy 10.3%. Thus, natural territories dominate public preferences.

These figures establish precise boundaries of the analysis. There is enough evidence here to discuss the structure of public values in aggregates, but it would be an exaggeration to call the evidence an individual behavioral model. The most significant implication of Table 1 is that this analysis relies on multiple types of tabular evidence simultaneously. Respondent figures, marker geometries, correlation coefficients, and preservation points are all discussed as a whole.

**Table 1.** Numerical record used in the analysis.

| Evidence element | Numerical content | Analytical role |
|---|---|---|
| Respondent base | 1044 respondents | Defines the denominator for preservation-point interpretation. |
| Mapped valued landscapes | 3132 total markers: 1734 points, 1120 polygons, 278 lines | Shows that public value was expressed through site, area, and linear geometries. |
| Sustainability-value relations | 66 value pairs; 53 significant pairs; strongest coefficient $r_s = 0.596$ | Supports the reading of values that tend to be prioritized together. |
| Land-use selectivity | 156 value–land-use pairs; 37 significant but weak correlations | Identifies land-use classes with consistent or mixed value associations. |
| Land-use co-occurrence | 78 land-use pairs; 72 significant pairs; strongest positive coefficient $r_s = 0.348$ | Locates compound corridor conditions and adjacent land-use assemblages. |
| Preservation thresholds | $q_1 > 50$: 412 respondents; $q_1 > 60$: 248 respondents; $q_1 > 70$: 143 respondents | Measures the concentration of preservation choice for one valued place. |

## 3.2. Relational Analysis of Values and Land-Use Classes

Co-Valuation Tension Graphing involves four types of readings. First, the sustainability-values coupling is explored. Let $V = \{v_1, \ldots, v_{12}\}$ be a set of the twelve sustainability values considered in this evidence collection. For any two values $v_i, v_j \in V$, the corresponding Spearman coefficient $r_{ij}$ reveals whether the value pair tends to be allocated jointly or in opposition. Relations with the coefficient above zero represent co-valuated priorities, while relations with negative coefficients represent value tensions.

Second, the land-use selectivity is explored. Let $L = \{l_1, \ldots, l_{13}\}$ be a set of land-use classes recorded in the tabular record. For any land-use class $l_k \in L$ and any value $v_i \in V$, the corresponding Pearson coefficient $a_{ki}$ is interpreted as a land-use/value relation. As the land-use-value relations in question tend to have relatively low coefficients, sign patterns within sets of relations are emphasized rather than individual relations themselves. This approach is crucial when analyzing agricultural terrain since positive environmental and negative settlement-development signs occur simultaneously.

Third, the land-use co-occurrences are studied using corresponding coefficients. This is necessary since road infrastructure exhibits weak land-use sustainability-value selectivity in this dataset. Its planning significance appears only in its adjacency to business terrain, semi-built terrain, agricultural terrain, railway, forest, and water-oriented surfaces.

Fourth, the distribution of preservation points per respondent is analyzed. The preservation point analysis is based on each respondent allocating 100 points among three valued places. Let $q_1$ be the maximum number of points allocated by one respondent to one place. A value exceeding 50 indicates the respondent's overwhelming preference for this place; exceeding 60 points means that the distribution becomes less balanced and exceeding 70 points represents a clear preservation tail. The compression of preservation points with the threshold at 60 points is measured by $\kappa_{60}$:

$$\kappa_{60} = 1 - \frac{N(q_1 > 60)}{N}.$$

This coefficient is not a performance index. It provides a compact representation of the number of respondents whose preservation point distribution does not include a single clear winner. In this example, the large value suggests the need for compressed interpretation.

# 4. Results

## 4.1. Geometrical Distribution and Analytical Focus

The analysis is conducted based on a rather rich mapped record. With 1044 total respondents, there are precisely three mapped valued landscapes provided by each respondent, for 3132 total mapped items. Points make up 55.4% of the mapped items, polygons are 35.8%, and lines represent 8.9% of the evidence. Point dominance shows that a large number of respondents selected places explicitly. At the same time, the polygon proportion is quite high, which suggests that public valuation tended to be more general rather than location-specific. Line presence is less substantial, but it is still essential since it reflects various routes, waterways, landscape edges, and elongated valued areas potentially affected by future corridor decisions.

Thus, the geometry mix of the evidence collection matters for the analysis since point marker geometry can be seen as concentrated place valuation, but polygon or line geometry shows that value extends beyond it. Since the road corridor is a linear intervention, crossing the three geometries mentioned, it is critical to interpret mapped public values as a variation of spatial information rather than sets of locations. Simply counting frequencies is not sufficient for corridor planning analysis.

## 4.2. Sustainability Values' Correlations

The sustainability values' correlations suggest that their prioritization is structured. The maximum positive coefficient between sustainability values is observed between company settlement and development potential ($r_s = 0.596$). This suggests the existence of the coherent value domain with a development theme. Respondents who prioritize company settlement also prioritize development potential, as well as citizen settlement and accessibility. Thus, the development-oriented domain of sustainability values is based on local residence and economic activity.

The distinct environment substrate domain is found around water bodies, soil, ecology and biodiversity, and energy/materials values. The maximum positive relation is found between water bodies and soil, with $r_s = 0.492$. Ecology and biodiversity is positively correlated with soil value, and energy/materials also correlates with soil ($r_s = 0.448$). Thus, environmental values tend to correlate. Respondents tend to prioritize not one of these environmental values but all of them.

In addition, there are interesting relations between spatial use and spatial quality sustainability values, whose coefficient is $r_s = 0.361$. This is important for corridor planning since arguments about infrastructure compactness, land take reduction, or spatial efficiency should not ignore quality factors.

The coefficients in Table 2 show that road-corridor planning should not communicate benefits and losses as single independent categories. Accessibility belongs partly to the settlement side of the value structure, while ecological and soil values belong to an environmental substrate side. When a corridor alternative improves access but crosses agricultural or water-related land, public concern may arise not because residents oppose access in itself but because the access benefit enters a value field that also contains soil, water, ecology, and spatial quality.

**Table 2.** Dominant sustainability-value couplings.

| Value pair | Coefficient | Planning interpretation |
|---|---|---|
| Company settlement–development potential | 0.596 | Strong development-oriented coupling. |
| Water bodies–soil | 0.492 | Environmental substrate relation linking hydrology and soil. |
| Company settlement–citizen settlement | 0.383 | Business and residential conditions partly reinforce each other. |
| Ecology and biodiversity–soil | 0.376 | Ecological value is connected to ground conditions. |
| Spatial use–spatial quality | 0.361 | Spatial efficiency and perceived quality are jointly valued. |
| Energy and materials–soil | 0.324 | Material-use concerns are linked to land-substrate conditions. |
| Accessibility–citizen settlement | 0.320 | Access and residential attractiveness are moderately connected. |
| Accessibility–ecology and biodiversity | -0.178 | Mobility value is weakly separated from ecological value. |
| Citizen settlement–ecology and biodiversity | -0.155 | Settlement priority shows weak tension with ecological priority. |
| Accessibility–soil | -0.149 | Mobility value is weakly separated from soil priority. |

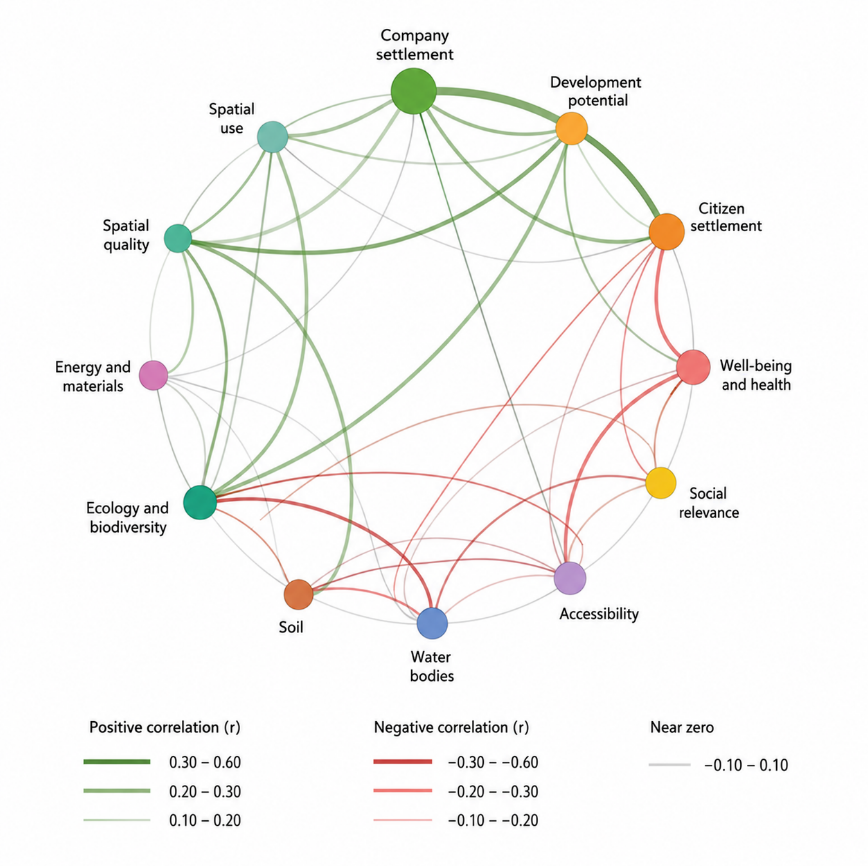


**Figure 2.** Sustainability-value couplings among the twelve public values.

The network presented in Figure 2 demonstrates the difference between the development-based and the environmental/substrate connections clearly. Positive, strong ties cluster in the vicinity of company settlement, development potential, water bodies, and soil, whereas weak negative ties connect accessibility/settlement values to ecological and soil values. Consequently, in the language of urban planning, it is clear that the public valuation involves both reinforcement and tension at the same time. Arguments for corridor design based on single benefits will not reflect the true structure of the public valuation.

## 4.3. Selectivity in Land-Use Classes in Corridor Context

Selectivity indicates those land use classes that demonstrate clear, mixed, or weak association of values. Agricultural terrain stands out as the most significant in this context among all classes. Agricultural terrain has positive associations with the values such as ecology and biodiversity, soil, water bodies, and spatial quality. At the same time, agricultural land is negatively associated with the following values: accessibility, development potential, citizen settlement, well-being and health, social relevance, and energy/materials. Thus, despite the absence of agricultural land within the settlement and development value domains, it should not be considered neutral land use with no particular associations other than agricultural.

In contrast, built terrain represents a quite different set of land-use associations. Built terrain is associated positively with the following values: development potential, citizen settlement, social relevance, and company settlement, while it is associated negatively with water bodies and ecology and biodiversity values. The built land pattern is thus closer to being associated with settlement and development rather than environmental values. As a result, while developed terrain allows for stronger accessibility and development justifications than agricultural land, the negative environment indicators remain to be addressed nonetheless.

Both forest and water classes have a much clearer focus on the preservation-stable values. Forest is associated negatively with accessibility, development potential, citizen settlement, well-being and health, and social relevance. Water classes demonstrate the highest correlation with the water body value, followed by its association with the environmental values. Finally, recreational land is positively associated with ecology and biodiversity to a lesser extent, meaning that public use terrain can also imply ecological significance. Road infrastructure, meanwhile, has low direct coefficients for sustainability values.

**Table 3.** Selected land-use selectivity signals.

| Land-use class | Main sign pattern | Planning interpretation |
|---|---|---|
| Agricultural terrain | Positive with ecology and biodiversity, soil, water bodies, and spatial quality; negative with accessibility, development potential, citizen settlement, well-being and health, social relevance, and energy/materials | Hybrid land-use class with environmental value and corridor vulnerability. |
| Built terrain | Positive with development potential, citizen settlement, social relevance, and company settlement; negative with water bodies and ecology and biodiversity | Settlement-development class with environmental tension. |
| Forest | Positive with energy/materials; negative with accessibility, development potential, citizen settlement, well-being and health, and social relevance | Environmental class with limited alignment to settlement-development values. |
| Recreational terrain | Positive with ecology and biodiversity | Public-use class with ecological affinity. |
| Water | Positive with the water-bodies value and environmental orientation | Hydrological class with preservation relevance. |
| Road infrastructure | Weak direct coefficients across values | Planning meaning depends on adjacent land-use assemblages. |

The selectivity characteristics provided by Table 3 give an easy way to see why agricultural terrain turns out to be an ambiguity-sensitive land use category. Built terrain and business terrain may easily be considered in terms of development or settlement advantages, whereas forest and water can easily be considered from the perspective of preservation of natural surroundings. Agricultural terrain lies somewhere in-between. It is environmentally relevant, spatially relevant, and often subjected to infrastructure proximity.

The land-use selectivity profile shown in Figure 3 demonstrates this agricultural tendency clearly enough. There is a set of positive bars on the environmental and spatial qualities side, and a set of negative bars on the accessibility, development, settlement, health, and social side. The meaning of it is not that agricultural terrain should necessarily be avoided during routing. Its interpretation as a residual reserve of the corridor is inappropriate due to the structure of public value attached to agricultural terrain.

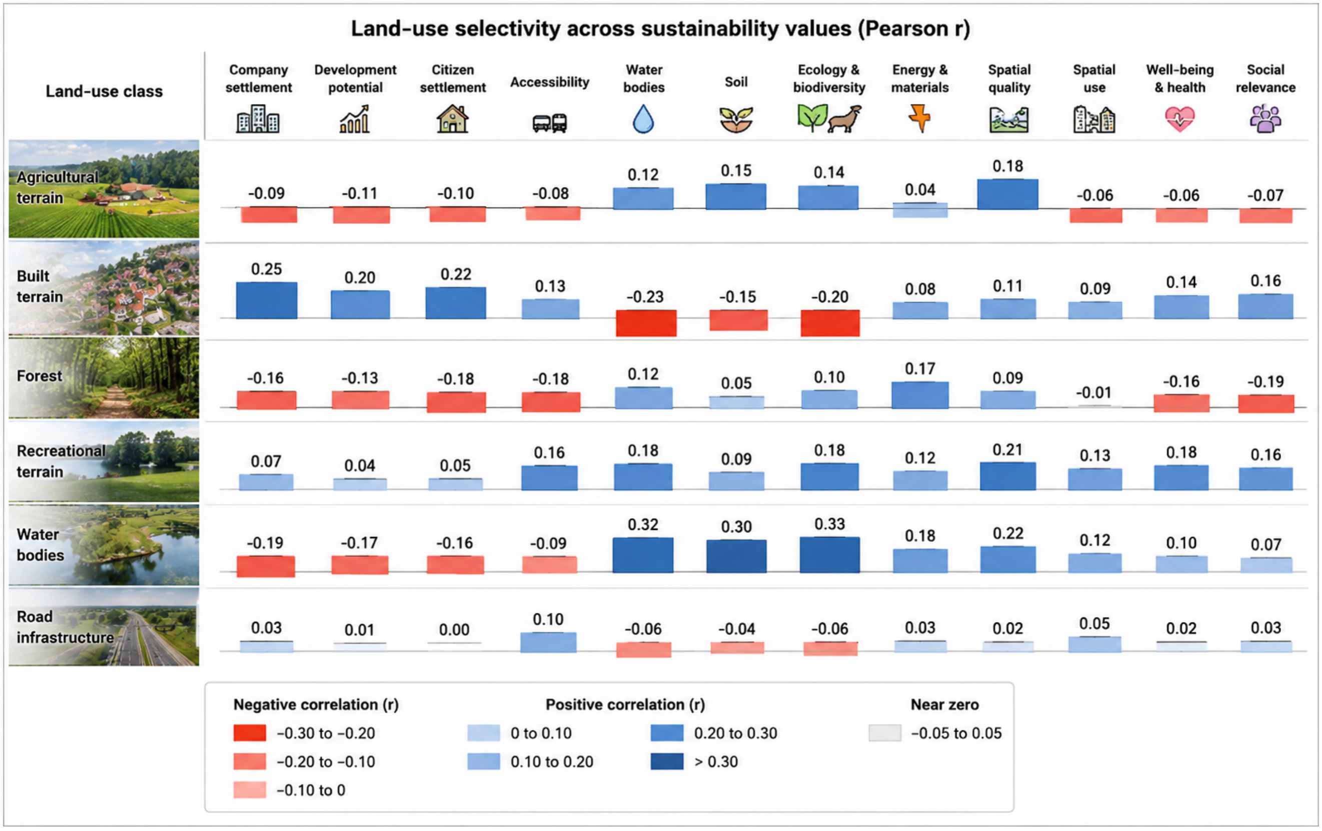


**Figure 3.** Land-use selectivity profiles for principal corridor-related classes.

## 4.4. Road Proximity and Compound Land-Use Situations

It follows from co-occurrence results that road infrastructure requires relational interpretation. The strongest positive relation among all selected land-use pairs is dry natural terrain–forest with $r_s = 0.348$. This suggests that natural land-use surfaces are likely to form compound situations, and not stand alone. If any routing involves passing through this type of compound surface situation, then it becomes a question of ecological, landscape, and natural aspects altogether.

Road infrastructure tends to correlate positively with business terrain ($r_s = 0.324$), semi-built terrain ($r_s = 0.282$), agricultural terrain ($r_s = 0.250$), and railway ($r_s = 0.224$). Thus, there are at least four different types of corridor context involved. Road–business relation represents economic corridor settings. Road–semi-built relation represents transitional settings. Road–agricultural relation is particularly important with regard to the preservation context explained above. Lastly, road–railway relation refers to multistructure environment, where various transportation surfaces converge.

Together, the co-occurrence signs in Table 4 show that corridor planning should not evaluate roads only by the land directly occupied by pavement. The land beside the road changes the public meaning of the intervention. A route beside business terrain may be interpreted through access and development. A route beside agricultural land may raise concern because the same land carries environmental and spatial-quality associations. A route beside forest or dry natural terrain may enter a stronger preservation condition.

**Table 4.** Selected land-use co-occurrence relations.

| Land-use pair | Coefficient | Corridor-planning interpretation |
|---|---|---|
| Dry natural terrain–forest | 0.348 | Natural surfaces form coherent compound landscapes. |
| Road infrastructure–business terrain | 0.324 | Roads frequently align with economic land-use surfaces. |
| Built terrain–agricultural terrain | -0.313 | Urbanized and agricultural surfaces are spatially differentiated. |
| Road infrastructure–semi-built terrain | 0.282 | Road settings include transitional or partly developed surfaces. |
| Road infrastructure–agricultural terrain | 0.250 | Agricultural land is repeatedly implicated in road adjacency. |
| Road infrastructure–railway | 0.224 | Transport infrastructure classes often co-occur. |

The corridor montage in Figure 4 translates the co-occurrence coefficients into recognizable land-use settings. Economic, agricultural, and multi-infrastructure corridors are visually different planning situations even when all include road infrastructure. This reinforces the central result that roads gain public meaning through their relation to surrounding land-use assemblages.

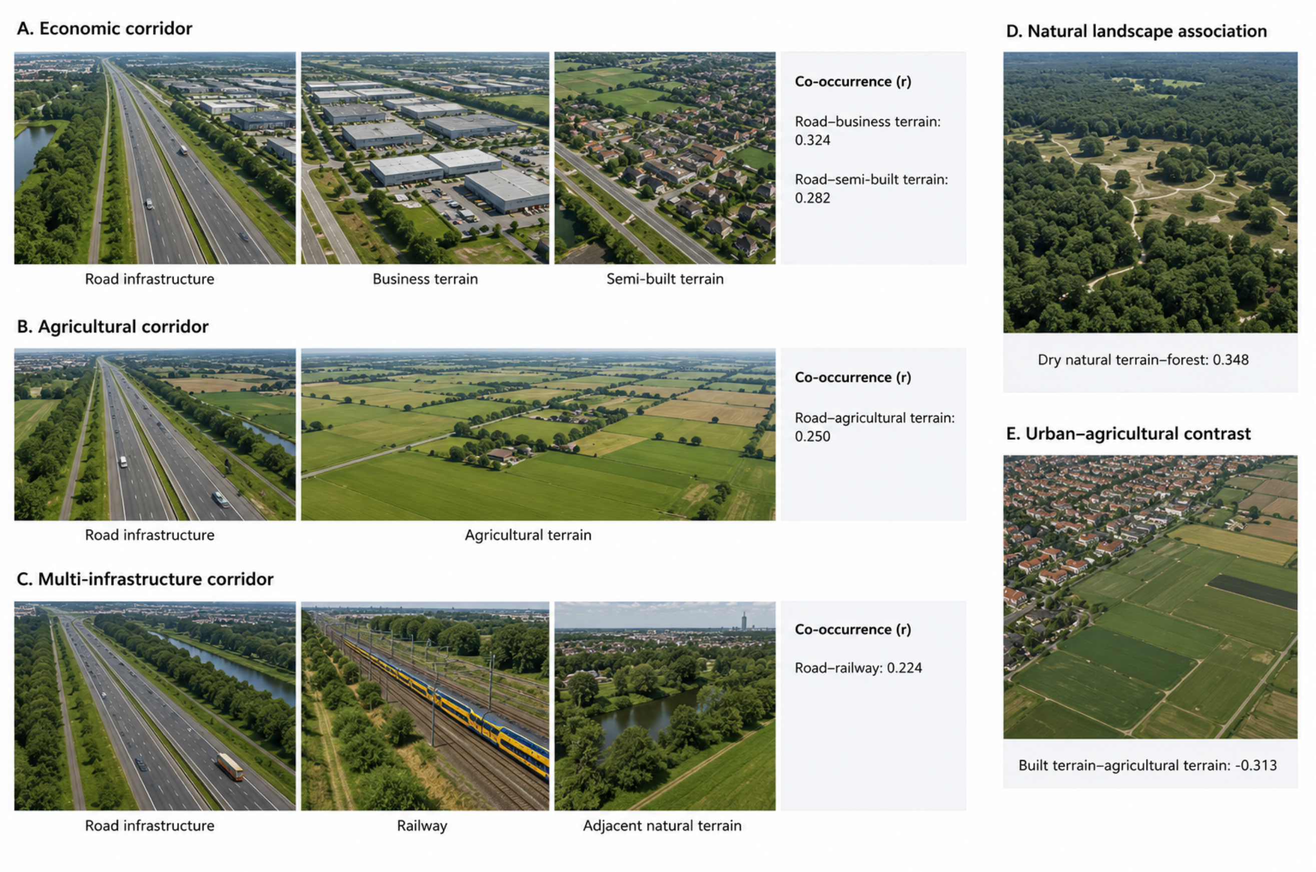


**Figure 4.** Compound land-use settings around road corridors.

## 4.5. Preservation-Point Compression

Preservation-point allocation reveals how difficult it was for respondents to select one place as clearly more important than the other two. A total of 412 respondents, or 39.5%, assigned more than 50 points to one place. This means that fewer than half of the respondents gave one place a simple majority of the preservation points. The

60-point threshold is more selective: 248 respondents, or 23.8%, exceeded it. The 70-point threshold identifies a small strong-preference tail of 143 respondents, or 13.7%.

The threshold pattern in Table 5 confirms that sharply concentrated preservation choice was a minority response. Most respondents did not transform three valued places into one clearly dominant place for protection. This result should not be interpreted as indifference. It shows that public landscape valuation may be distributed across several places, especially where different places carry different kinds of value.

**Table 5.** Preservation-point thresholds.

| Highest allocation to one valued place | Number of respondents | Share of respondents |
|---|---|---|
| More than 50 points | 412 | 39.5% |
| More than 60 points | 248 | 23.8% |
| More than 70 points | 143 | 13.7% |

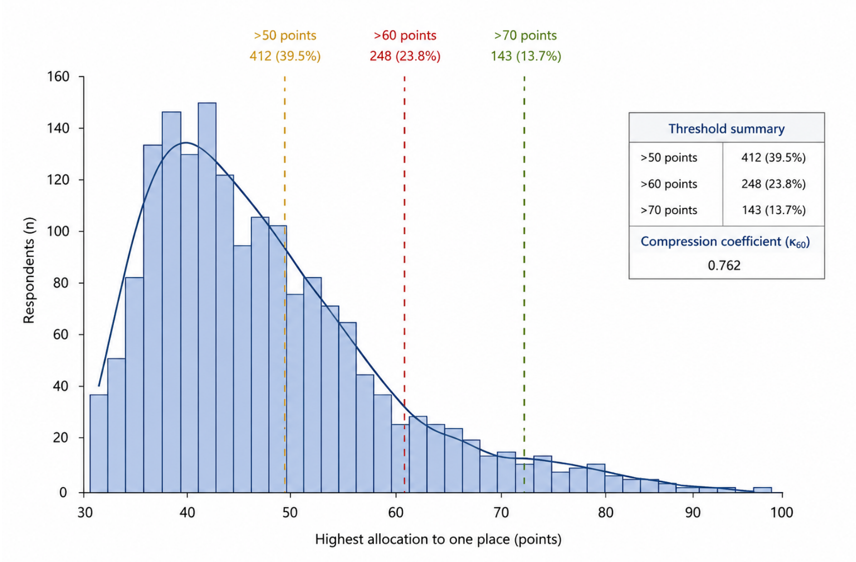


**Figure 5.** Distribution of the highest preservation-point allocation.

The distribution in Figure 5 shows the same result visually. Values cluster near the lower part of the 30–100 point range and decline toward the strongest thresholds. The right tail is important because it confirms that some respondents did make a dominant preservation choice. Yet the smaller size of that tail means that most respondents expressed a compressed preference rather than a decisive hierarchy.

The 60-point compression coefficient is

$$\kappa_{60} = 1 - \frac{248}{1044} = 0.762.$$

This suggests that, at this level, less than a quarter of respondents awarded above 60 points to a single place. In terms of planning implications for corridors, this means that even when the top choice is only weakly dominant, it does not give the planner license to sacrifice other places with lower rankings. There is reason to believe that quite a few respondents felt difficulty letting go of several mapped places.

## 4.6. Planning Classes Generated by the Evidence

By putting these findings together, four types of planning condition become evident. Preservation stable conditions are associated with the mutually reinforcing environmental value association and natural land-use occurrence. They are most clearly represented by forest, dry natural terrain, and water-oriented landscapes. These call for early avoidance, protection of continuity, or high quality compensation but not minimum mitigation.

Negotiable development conditions are found where settlement, company, accessibility and development values coincide with built or business land use classes. Such conditions might make better candidates for improvement approaches but even here attention must be paid to addressing any environmental impacts. Corridor-dependent conditions pertain to areas of weak value selectivity in themselves but gain value through land use adjacencies.

The most unique finding is that of ambiguity sensitive conditions. An example here is agricultural terrain, which has strong value connections but is open to road adjacencies at the same time. In such a case the planning issue does not involve preserved nature but open development land either. What is important here is the disconnect between spatial availability and value multiplicity.

The classes in Table 6 are not route-selection rules. They are interpretive categories for early and intermediate planning stages. Their value lies in preventing three errors: treating all mapped values as equivalent, treating agricultural terrain as empty reserve, and treating compressed preference as weak public concern.

**Table 6.** Planning classes from the combined interpretation.

| Planning class | Evidence pattern | Planning use |
|---|---|---|
| Preservation-stable | Environmental value coupling with natural land-use co-occurrence | Prioritize avoidance, continuity, or robust compensation. |
| Ambiguity-sensitive | Mixed land-use selectivity with compressed preservation choice | Use careful deliberation before narrowing route options. |
| Negotiable development | Settlement-development coupling with built or business land-use selectivity | Communicate access, settlement, and development benefits while managing environmental loss. |
| Corridor-dependent | Weak direct road selectivity but meaningful adjacent land-use relations | Interpret road segments through surrounding land-use assemblages. |

The typology in Figure 6 places the four classes around the corridor decision. The agricultural field is deliberately positioned as ambiguity-sensitive because that is where mixed value signals and road pressure coincide. The classification is strongest when it is used before route alternatives have become fixed, since that is the moment when public-value interpretation can still shape the design conversation.

It is worth noting that the procedure is particularly useful at a certain planning stage. Specifically, the time of using the table data is before the justifications of corridor alternatives are made public. In terms of Figure 7, the optimal application point is prior to the final approval stage.

**Figure 6.** Planning classes around the central road-corridor choice.

**Figure 7.** Planning-stage use of the tabular PPGIS analysis.

## 5. Discussion

The findings confirm that aggregate PPGIS evidence can be used for preservation-tension diagnosis. As can be seen from Table 2, there is no need to construct a single list. Rather, one may use aggregate evidence to understand where values cluster, where land-use classes hold distinctive meanings, what makes road corridors sensitive, and why preservation choices are compressed in the distribution of points.

As shown above, the strongest value-coupling evidence concerns the development value-domain in terms of company settlement. It shows that respondents were not merely expressing their antipathy toward development, as they had strong positive relations between company settlement and development potential. The finding indicates that road corridor improvements can contribute to public welfare by promoting better accessibility and settlement-development function. What is dangerous in this case, however, is that the latter value-domain may be considered the only relevant one.

The second domain relates to environment substrate. The connection between water bodies and soil, ecology/biodiversity, and energy/materials demonstrates that any impact made to one feature automatically extends to other environmental values. One should be aware that changes in agricultural or natural lands mean changing multiple features, which is why they should be considered from the sustainability perspective. The point is consistent with existing research on landscape sustainability, which shows that ecosystems and human well-being are linked [21, 26, 29].

Perhaps, the most interesting practical finding concerns agricultural terrain. Despite its seeming lack of formalized preservation and engineering constraints, agricultural land proved to be a carrier of value and ambiguity in the planning process. Agricultural terrains are positively coupled with ecology/biodiversity, soil, water bodies, and spatial quality. In other words, they are not a residual category in corridor planning. It is necessary to understand what values they may have to avoid misperceptions when making route comparisons and designing mitigation.

Road infrastructure appears to play an essential role in this case because, in terms of Table **??**, agricultural terrain co-occurs positively with road infrastructure. This is another reason for considering such terrain ambiguous in the preservation context because it combines the features of development terrain and natural class. This characteristic calls for additional comparison work, buffering design, and explanations that would be unnecessary if agricultural land was a regular low-confrontational feature.

In turn, the preservation-point results further clarify the preservation choices that can be observed in corridor-planning processes. One may conclude from Figure 8 that dominance of preservation is limited by a low threshold in 23.8% and high threshold in 13.7%. One may interpret the latter outcome either as weak preservation preferences or preference compression. In other words, respondents might have had positive feelings towards all three mapped places and did not want to express their domination of a single place. Such an interpretation aligns with bounded rationality theory [23] and general landscape planning practices [22].

The difference between weak preference and preference compression is significant from a planning standpoint. If one misinterprets compressed preferences as public indifference towards the preservation values, one risks creating alignments that will face opposition once residents realize that they affect valuable landscape elements. However, treating all preservation values as equally restrictive makes it impossible to apply public involvement in decision-making. The Co-Valuation Tension Graphing approach allows for distinguishing these cases.

As demonstrated in Figure 8, the results of the current research can be applied in the context of corridor planning. While each landscape setting – natural, agricultural, and multi-infrastructure – may allow the construction of the line, their meaning varies widely in the context of spatial review. It is possible to identify areas that require careful avoidance and compensation, areas that require deliberative work, zones that allow for negotiations about access and settlement benefits, and areas whose meaning depends on adjacency.

It follows that PPGIS evidence should be used in planning as a tool of route evaluation. This point aligns with the existing planning communication studies that emphasize the importance of knowledge production in the pre-decisional stage of planning [10, 25]. As can be understood from Figure 7, the current analysis should be conducted in the alternative-evaluation and explanation phase to provide valuable input on where to conduct additional discussion work.

**Figure 8.** Spatial reading of corridor sensitivity across contrasting landscape settings.

There are a few limits that need to be taken into account. First, aggregate tables can never replace the detailed reasoning of individual respondents or environmental impact assessment. Second, weak coefficients may signal pattern occurrence, not the likelihood of a certain event. Third, the methodological relevance of the current evidence depends heavily on the quality of the participatory survey, classification of land use categories, and preservation-point task. Despite the limits, the procedure has considerable usefulness.

Finally, it is necessary to note that the findings are derived from a study on Co-Valuation Tension Graphing that has a broader context. One may misinterpret participatory maps as democratic tools and create a planning process that fails to engage public stakeholders effectively [1, 8, 19, 20]. However, the findings obtained here are relevant because they show that both approaches remain complementary. The former allows for identifying valuable landscape elements, whereas the latter is responsible for explaining trade-offs and justifying route alignments.

## 6. Conclusions

Aggregate PPGIS evidence can diagnose preservation tension in road-corridor planning when residents distribute preservation priorities across several valued places. Tabular PPGIS evidence becomes planning-relevant when interpreted from four connected perspectives, namely, sustainability value-coupling, land use selectivity, land use co-occurrence, and preservation-point compression. The results suggest that some corridor choices are preservation-stable, some are ambiguity-sensitive, some are negotiable, and some are corridor-dependent.

In the empirical study focused on the Netherlands, public valuation proves to have structure. Thus, there is a strong development-oriented coupling in the shape of company settlement and development potential. There is also a strong environmental-substrate coupling of water bodies and soil. In addition, agricultural terrain turns out to be highly sensitive due to positive coupling with environmental and spatial quality attributes along with adjacency. Road infrastructure does not seem to have value selectivity but plays the key role in the planning process because it connects land use classes. Finally, public preservation choices prove to be compressed with a coefficient of 0.762.

In other words, public participation does not necessarily provide simple prioritization of preservation values, but it can give valuable guidance on where it is necessary to discuss trade-offs. Public value structure requires avoidance and adequate compensation in case of strong environmental coupling. Clear value structure in terms of company settlement and development potential suggests negotiating with respondents on ways to achieve development benefits. Special care should be taken with road adjacent agricultural terrains since they combine apparent availability with latent public value. Finally, the presence of preservation-point compression proves that trade-offs are complicated.

Thus, the current research provides an example of successful planning contribution through a methodological innovation. In other words, the procedure of Co-Valuation Tension Graphing is valuable in the process of road infrastructure planning because it allows for translating aggregate PPGIS data into a meaningful interpretation of public values without overstating precision. Used at early and intermediate planning stages, the procedure can identify the type of setting where careful avoidance, additional deliberations, or benefit-based discussion are needed.

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