6. Financial compensation and legal restrictions for using land for flood retention

Andras Kis, Arthur Schindelegger and Vesna Zupanc

6.1 INTRODUCTION

Flood retention to control flood runoff and cut flood peaks is considered to be an efficient flood protection measure (Munich Re, 2014). Typically, retained water in a technical understanding is not the flood runoff between dike lines but instead floodwater within (controlled) polders. The idea of orchestrating controlled flooding into designated retention areas upstream of vulnerable areas often leads to highly specialized and mono-functional technical constructions (Patt and Jüpner, 2013).

Retention areas for temporary flood storage can typically only be allocated to non-occupied areas (i.e. not constructed), which are usually occupied by agricultural areas. Furthermore, land for the construction of necessary accompanying technical structures (inlet, outlet, levee) is needed. As allocation of retention measures can sometimes be met with reluctance in local communities (Glavan et al., 2020), suitable financial mechanisms (Slavíková et al., 2020) must be established to encourage cooperation of local stakeholders and private owners to avoid long-term mistrust (Raška et al., 2019) in order to ensure successful implementation of retention measures. It is therefore essential to take a look into the theoretical as well as practical considerations of financial compensation to land owners providing retention services as well as land-use restrictions (Slavíková et al., 2020). The notion of property is not a universal one but rather specific for every national and constitutional context – as discussed by Albrecht and Nikolić Popadić (Chapter 3 in this volume). Planning interferes with property permanently as development options are granted or restricted (Van der Veen et al., 2010). Compensation is not granted for every planning-related depreciation. The OECD frames three triggers that should be taken into account here: (1) the degree of interference with property rights, (2)

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

the character of governmental measures (purpose, context) and (3) interference of the measure with reasonable and investment-backed expectations (OECD, 2004). If compensation is indispensable, it therefore depends on the degree of property interference and the specific legal context. Compensation for retention services that come with development restrictions are common in Europe but differ in detail among countries (Tarlock and Albrecht, 2016).

The chapter aims to disclose how 'fair' financial compensations for retaining water on (private) land can be calculated and how they are linked to legal titles to land as well as land-use restrictions. While some aspects besides economic ones such as personal attachment, substitutional areas and cultural value may also play a role in practical arrangements, they fall outside the scope of this chapter.

Firstly, the foundation of calculating compensation for individual assets and the different possibilities to disburse compensation via (a) buyout, (b) one-time payoff with additional payments on a yearly basis or connected to events or (c) in relation to actual events will be explained. As a second aspect, the chapter looks into the question of the composition of financial means. Financing can be secured from public funds according to a distributive scheme among public and private stakeholders or by private financiers only. Any compensation for granting property or usage rights goes typically with either a change in ownership, easements or land-use restrictions. For logical reasons, areas dedicated for flood storage need to maintain this service long-term. Therefore, the control of land use, construction or land transfer is a core issue of any retention project, yet often neglected.

The chapter aims to provide a systematic overview of the characteristics and role of compensation payments in flood retention projects and their connection to land-use restrictions. First, a theoretic section illustrates the underlying principles complemented with a desktop research-based presentation of relevant examples from European countries. It is therefore a descriptive secondary analysis to provide an introductory reading. The reader will receive a systematic overview on compensation and land-use restriction in connection with flood retention, an exemplary insight into the actual practice of European countries and an outline of essential aspects that need to be considered in designing compensation schemes (social, economic, environmental criteria).

6.2 GOVERNING LAND FOR FLOOD RETENTION

6.2.1 Costs and Benefits of Flood Retention

Similar to other types of flood risk management measures, retaining floodwater requires a long-term perspective on economic costs and benefits. In the planning stage, short-term constructing costs are immediate and visible, while

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

long-term benefits of reduced flood risk are less tangible. Flooding private land to provide retention services raises the question of compensation, as the benefits generally accrue to others than those who face the costs. Deciding on the rationality of the investment and calculating the compensation both require a good understanding of different types of costs and benefits related to designating a given piece of privately owned land for floodwater storage (Hartmann et al., 2019).

Project costs consist of several items that can be divided into short-term costs – including expenses for construction or land easement (Grčman and Zupanc, 2018) – and long-term operational costs. Costs for construction operations cover infrastructural development, which is almost always needed, whether it is building an inlet or outlet structure, a levee section, channel system adaptation or some other construction. Operational costs cover maintenance of the infrastructure and damages occurring in the event of flooding and losses connected to restrictions of land use. For most flood-retention sites, damage due to flooding the land will occur at times, but not every year. Potential cropland flooding may necessitate an adjustment in agricultural practices that may be unsuitable for certain crops or cultivation methods. Also, the use of specific pesticides may be forbidden. For example, in the case of hop production as described by Glavan et al. (2020), there is a complex system that the compensation of agricultural production strategy entails. From an agricultural perspective, four aspects need to be included in cost evaluation of compensation during the pre-flood management planning: (1) soil management (e.g. monitoring of soil quality, a technical manual for removal of flood slurry and debris), (2) management and maintenance of agricultural infrastructure (e.g. hop wires, drainage and irrigation systems), (3) tillage operations oversight (warning systems, farm economic analysis, dry detention reservoirs scheduling) and (4) adaptation to microclimate changes (frost protection, pest control, crop rotation adaptation). The change in possible land uses entails costs – via reduced profitability – for farmers, and in some cases, permanent loss of livelihoods due to decreased quality or size of arable areas. Less frequently, non-agricultural land is used for flood retention, such as football fields, parking lots and playgrounds. In these cases, much of the costs are related to cleaning the field and reconstruction or repair of damaged assets. Especially construction land is seldom considered for nature-based solutions for flood protection, as compensation costs of such areas would be extremely high.

The various benefits generally take the form of lower flood defense related costs and reduced flood damages, also to agricultural land which is usually exempt from flood protection plans (Holstead et al., 2017). There is a need for less dike development and maintenance, fewer people and sand bags for actual defense operations, and just as importantly, there is a lower risk that a costly

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

flood event happens. Quantifying flood risk is a complex effort as it requires hydrological modeling as well as sound economic estimates of damages in affected areas (Ungvári and Kis, 2018), but it is critical to be able to judge the economic merits of any flood risk related interventions. If land-use change is part of the floodwater storage-related arrangement, ecosystem services may emerge which offer other kinds of benefits that may be more difficult to quantify, and the private land owner can neither benefit from nor relate to it (Raška et al., 2019). Ecosystem services may consist of, for example, improved local hydrology, enhanced biodiversity, carbon sequestration and opportunity for recreational activities (Kiedrzyńska et al., 2015).

Some costs are immediate, others will occur in the future, and most benefits will also register with a delay, in connection with future flood events. To be able to compare costs and benefits, it is indispensable to bring them all to a common denominator. Present value is one such measure; annualized value is another. If projected benefits significantly exceed costs, then it makes sense to carry on with the idea of floodwater storage.

Under most flood-retention schemes, benefits will accrue mainly to settlements, while costs will register primarily with farmers and private land owners that provide the service of flood risk reduction. The latter generally demand compensation even if that is not always ensured by national regulation. In addition, some water retention measures may count as good agricultural practice that is already subsidized, therefore claims for additional compensation may not be legitimate (see Albrecht and Nikolić Popadić, Chapter 3 in this volume). The farmer survey of Posthumus et al. (2008), nevertheless, highlighted that farmers typically insist on compensation payments for their flood risk reduction services. The authors inspected both runoff control measures on upstream farms and water storage on farms in the lower parts of a catchment. If a measure constitutes a good farming practice, serving the interests of both the farm and the community, then farmers might be willing to carry it out without compensation. However, for any activities that entail costs for the farmers, there is unanimous agreement on the need for compensation. One of the findings of McCarthy et al. (2018) is that in England and Wales the availability of funding for compensation was the main driver for successful flood storage arrangements with farmers. A historic example for water management related compensation in the Netherlands is provided by Bos and Zwaneveld (2017). When the Zuiderzee (a bay of the North Sea) was closed off over a century ago by one of the largest ever water infrastructure projects, affected fishermen lost their income and had to choose new occupations. They were granted individual compensation which made up almost 5 percent of the total projected development cost.

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

Using a simplified scheme, it is feasible to assume that there is one group of beneficiaries and one group of service providers. Equation 6.1 illustrates the economic precondition of an operational arrangement:

$$B >= C_{comp} + C_t >= C_s \tag{6.1}$$

where: B is the risk reduction enjoyed by the beneficiaries (minus the cost of infrastructural measures paid by them); C_{comp} is the compensation paid to service providers; C_t is the transaction cost of concluding the agreement; and C_s is the total cost faced by service providers as a result of storing floodwater on their land (including the cost of infrastructural measures paid by them).

If the above formula holds, then there is a possibility for all players to benefit from the scheme – depending on the actual compensation arrangements. Putting this theoretically sound precondition into practice encounters difficulties with the uncertainty of valuing costs and benefits, e.g. the financial value of flood risk reduction. The asymmetry of information on costs and benefits can further complicate the analysis: farmers may know but not disclose the level of potential damage on their land. Therefore, the value of B and C may not be available as discrete figures, only as estimated ranges. However, as Collentine and Futter (2018) describe, flooding urban areas is generally costlier than flooding rural land, thus there is a lot of room for the formula to hold in case of upstream rural and downstream urban relations. The practice of the Environment Agency in England shows that benefits outweigh costs at a large number of farms (McCarthy et al., 2018).

From here on, we will concentrate on the compensation (C_{comp}), how it can be structured, what some of the pros and cons of its specific variations are, and which parties possibly contribute to its payment. We will also consider the transaction cost (C_t) when feasible.

6.2.2 Compensation Payments in Europe

Based on the introduced scheme, determining a compensation seems rather simple. However, in reality this can be a complex and sophisticated task, as it depends on the services provided, how risk is shared among involved stakeholders, how payments are structured, what kind of events trigger payments of the compensation, etc. In addition, there are difficult to monetize aspects such as personal attachment to a piece of land, lack of substitutional areas and the presence of cultural values. Each of these items may make it more difficult to reach an agreement or drive the level of compensation up.

As shown in Figure 6.1, payment may originate from various stakeholders. Payments by direct beneficiaries are frequently supplemented by local, regional or central government instalments; in fact, they often carry the bulk of

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

the burden. Besides, beneficiaries from retention measures are often not only downstream property owners but also infrastructure operators (e.g. highways, railway) that might help fund such prevention schemes. In general, monetary funding is used for compensation, but there are also examples of offering land in other locations in exchange for the land dedicated for flood retention, while sometimes the land itself is purchased by authorities, municipalities, etc. Concerning the timing of payments, there are various practices, none of which is dominant. Compensation payments might be disbursed event based, on an annual basis, in connection with establishing retention services in a one-time payoff or use a mixed scheme. And finally, there is a risk that increasingly frequent floods generate higher overall costs. Depending on the compensation scheme, these costs may increase the burden of either the beneficiaries or the service providers.

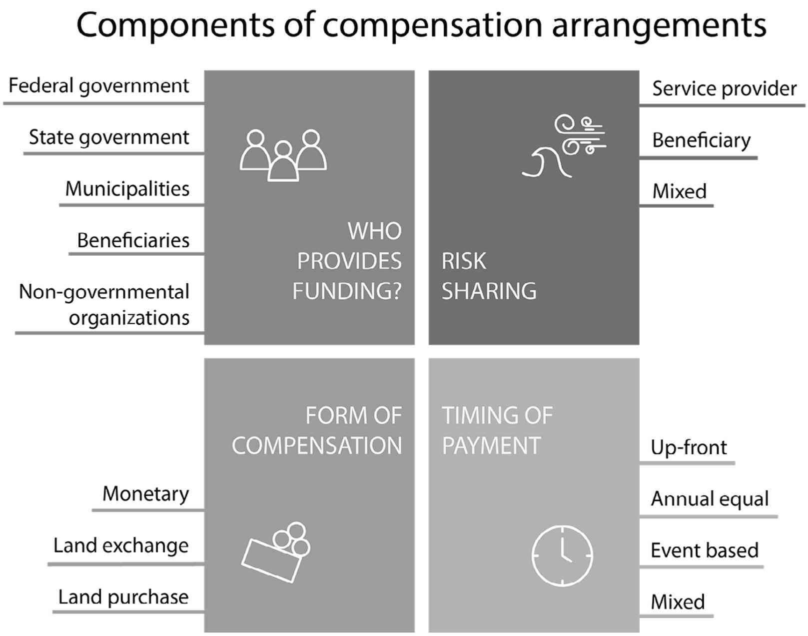

Figure 6.1 Typical building blocks of compensation agreements

Next, examples are drawn from European countries illustrating that various compensation schemes can work effectively, depending on local conditions.

In Hungary, following the record-breaking floods of the 1998–2001 period on the river Tisza, the government decided on the construction of a string of emergency polders along the river to avoid the exceedingly expensive contin-

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

ued heightening of the dikes. Until today, 6 major polders have been developed with a combined storage capacity of 720 million m^3, covering a total land area of 250 km^2. The polders are intended to mitigate infrequent, extremely large floods that occur only a few times in a century. The related damage, however, can be astronomic, justifying the costs associated with the construction and operation of the polders (Ungvári and Kis, 2018). The predominantly agricultural land inside the polders continues to be cultivated. Only the land area necessary for the construction of the locks and other structures, as well as the dikes surrounding the polders was purchased by the government through a process of expropriation. At the time of the construction, land owners with land inside the polders received a one-time payment to compensate for the inconvenience associated with the construction and future operation of the polder. The actual value of this compensation depended on the soil quality of the farm in question; on average it was about 390 EUR/hectare, corresponding to 10–20 percent of the value of land at the time (Weikard et al., 2017). In addition, in case floodwater is released into the polder, full damage compensation is guaranteed by regulation. So far this has happened only once, when the Tiszaroff polder was put to use in 2010. Both the initial, one-time payment and any event specific compensation is paid by the central government – which is also in charge of most flood protection infrastructure and operations in Hungary; in essence, the government bears all flood risk. Downstream beneficiaries consist of many different settlements and they do not take part in financing the compensation.

Also in Hungary, a dike relocation project is currently under execution along the river Tisza, at Fokorúpuszta just north of the city of Szolnok. Over 300 hectares of former agricultural land is being added to the floodplain, targeting flood risk reduction and enhanced ecosystem services. Following the relocation of the dike, this area will be under water about 10 per cent of the time and thus it will no longer be available for crop production (REKK, 2020). The land area is purchased by the government and turned mainly into meadow, with a patch of forest. The government offers a price to land owners that is approximately 20 percent above market prices. If this offer is refused, then expropriation is applied, resulting in higher transaction costs, but potentially a lower price premium. Recently, the majority of land owners come to an agreement with the government and expropriation happens relatively infrequently. As agricultural activities will cease in the area, no party will have to face the risk of flooding.

In the case of the Seymaz river renaturation in Switzerland – targeting flood risk reduction, habitat improvement and water-quality recovery – agricultural land was converted into natural area (NWRM, 2013a). As a result of the project, 800,000 m^3 of water can be retained. Farmers initially opposed the idea, but their resistance was eased through involving them in the process, and engaging with them in negotiations which resulted in alternatives for

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

compensation for their lost farming opportunities. Farmers had a choice of either selling their land at a price of 16,000 EUR/ha or keeping and managing it based on the principles laid out in a 'nature contract'. In the latter case, the compensation was set at a rate of 819 EUR/ha and year. Additional compensation was offered to mitigate the disturbance during the construction period and participating farmers also benefited from a tax advantage. The funds came from the government (the canton and the state), while downstream beneficiaries of reduced flood risk did not directly contribute to financing.

Austria might be a small state in the heart of Europe but it has established a complex flood risk management framework and practice (Rauter et al., 2019). Compensation payments do not only play a role in buyouts that are necessary for protection infrastructure. Especially in controlled retention areas, farmers receive compensation for an increased flood risk. A well-researched case is located in the alpine municipality of Altenmarkt on the river Enns. Flood evaluations revealed a serious flood risk for the main village leading to the development of an integrative protection scheme with a river widening, dams and the construction of a controlled retention basin. Initial project costs were split between federal and state funds (84 percent) and contributions coming from the municipality of Altenmarkt and the private beneficiaries (16 percent) that were organized in a water cooperative. The 12 affected private land owners that provide in total 20 ha for retention purposes receive a yearly payment of EUR 0.25 per square meter, a total of about EUR 50,000 per year, financed by the water cooperative. This compensation covers the restrictions concerning the land use and damages occurring due to flooding. Land owners are still eligible for compensation from the federal disaster relief fund (Löschner et al., 2019). This case demonstrates that running costs can also be taken over by beneficiaries themselves.

In Slovenia, dry detention reservoirs are frequently used as a measure to alleviate flood risk (Glavan et al., 2020). When implemented on agricultural land, policymakers assume the agricultural use will continue. In case of extensive land use, such as meadows, this may be possible. However, the potential consequences of flooding present a threat to the productive capacity of a rural landscape through negative impacts to the soil properties, consequent decrease in crop quality and quantity, and in case of more intensive agricultural areas, potential damage to the existing agricultural infrastructure (i.e. irrigation equipment). The Slovenian government prepared a Detailed Plan of National Importance to ensure flood safety in the Lower Savinja Valley, an area subjected to many floods in the past due to the torrential nature of Savinja river tributaries. The proposed plan foresees the implementation of a chain of 10 dry reservoirs (520 ha of agricultural land) to provide a higher level of flood protection for the downstream cities of Celje and Laško. Organized in a civil initiative, private land owners financed a study with potential alternative

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

locations for smaller dry detention reservoirs in the upstream, hilly areas of the Savinja tributaries. The study was not considered and was dismissed. As there is intensive hop production, losing areas would necessitate intensification of hop production in other areas not in dry detention reservoirs, in order to compensate for the loss of income. This would be possible through an additional water source for irrigation that is hampered in summertime through low discharge of surface waters, and the civil initiative proposed wet reservoirs would be constructed as a source of water for irrigation. Thus, in this case, 'in-kind' compensation may be the solution, but negotiations with private land owners are still ongoing.

In the case of the dike relocation project on the river Elbe close to Lenzen in Germany, former farming land was acquired by the state and turned into a floodplain area. To ensure the continued livelihoods of the farmers, instead of simply purchasing or expropriating the land, plots of land were offered in exchange (NWRM, 2013b). The transaction was managed by the German Federal State of Brandenburg. Some of the offered land was already state-owned, and some land was purchased as land to be exchanged for farmland. Altogether, 420 hectares of land were acquired by the state from 60 land owners. The project was financed mainly by the Federal Government, and contributions by the State of Brandenburg, Burg Lenzen e.V, and also by some nature conservation NGOs. Besides construction costs related to the dike relocation, and the cost associated with land purchase, additional compensation was paid to the relocating farmers for the inconvenience caused.

In the United Kingdom there are various examples of compensation (Penning-Rowsell and Priest, 2015). In Scotland during the 2000s, the Rural Stewardship Scheme offered £25/ha per year to land owners if they agreed that their land would not be protected in case of floods. In some instances, environmental and nature protection NGOs supplement the payments of the state in exchange for additional ecosystem services, e.g. adopting grazing instead of crop management, or planting specific shrubs or hedges. The additional payment may tip the farmer's decision to engage in an agreement (Scottish Executive, 2005). A similar case can be seen in for England, where the Royal Society for the Protection of Birds (RSPB) is willing to co-finance schemes with a habitat restoration component (McCarthy et al., 2018).

In England along the river Trent, land was purchased by the River Boards back in the 1930s and 1940s, and subsequently rented out to farmers. The rental agreement defines no flood compensation; thus farmers carry the risk of flooding and they adjust their practices accordingly (Scottish Executive, 2005).

During the last three decades the Environment Agency of England has concluded agreements with farmers to allow flooding their land ('flowage easement'). These negotiated agreements consider flood return periods, current

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

land value derived from land-use activities and business reorganization costs when applicable. Negotiations tend to be lengthy, requiring substantial transaction costs, but estimates for these costs are not available. Depending on the agreement, compensation payment may be up-front in one sum, or an annual payment for the floodwater retention service regardless of whether a flood actually takes place in a given year. Up-front payment is preferred by the Environment Agency as that reduces transaction costs (McCarthy et al., 2018). It also provides enhanced opportunities for farmers for business readjustment or buying a new piece of land with a low risk of flooding. While flowage easement is the preferred and more frequently used arrangement in England, if an agreement with a farmer cannot be reached, then in justified cases compulsory purchase is also a legal option. For example, if there are a number of interconnected farms that can only be flooded together, and all farmers agree on flowage easement except for one, then compulsory purchase can be exercised for that farm.

6.2.3 Usage Restrictions for Retention Areas

Land that is dedicated to flood retention in controlled (or sometimes also uncontrolled) polders needs to be the target of a restrictive land-use policy. There are three fields of action to be distinguished here: (a) the control of agricultural land use and cultivation, (b) the control of any construction activity and (c) the control of land transfer. For uncontrolled polders and/or simply inundation areas between dike lines, there might be a less restrictive approach as flood probabilities and intensities are not directly changed by measures; nevertheless, all of these restrictions eventually mean a decrease in land value and therefore are causally linked to applied compensation schemes.

The rationales behind regulation of floodplain development were categorized by Dunham (1959) in three cases: (i) regulating development to minimize flood damages that provide a public benefit to citizens – those who are burdened receive compensation; (ii) regulation that prevents a property owner from using his/her property in a way that damages other property owners; and (iii) where building in flood-prone areas is a moral hazard behavior. If land owners can rely on the compensation of losses, there is no incentive to be risk sensitive (Dunham, 1959). While the compensation discussion tackles especially the first rationale, the discussion of usage restrictions targets the other rationales. Undesirable and detrimental behavior should be avoided and managed by strict regulations.

Discussing usage restrictions, a distinction between controlled and uncontrolled retention, as well as flood runoff areas is essential. Restrictions for the latter are typically already included in general provisions of planning regulations aiming to prevent and control development in flood areas and manage

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

them as low-risk areas. Such regulations are very common in European countries that link building bans or zoning restrictions directly to flood hazard classifications (e.g. Nordbeck et al., 2019). Controlled and uncontrolled polders, though, mean an increased flooding probability and/or inundation depth as well as the need for a (strict) control of land use.

6.2.3.1 Control for cultivation

Agricultural production or forestry in uncontrolled and even more in controlled polders can have considerable impacts on flood events – of course depending on the scale of the flood event. Generally, plants in flood runoff and retention areas can have a positive impact by decreasing the velocity of runoff. However, their volume is in direct competition for space with flooded water and can, if the vegetation is not considered in hydraulic calculation, have a negative impact. Furthermore, vegetation debris can cause problems with technical infrastructure, such as inlet and outlet structures of controlled polders or bridges. Smaller tributaries are more sensitive to debris clogging. Filling of controlled polders should be strictly scheduled (Glavan et al., 2020) in order to successfully relieve flood peaks and operate smoothly at any time. Another important aspect in controlling cultivation is the damage potential. For example, seawater intrusion or waterlogging can cause severe damage to cultivation or even a complete loss of yield that triggers a compensation demand.

Formal spatial planning instruments are typically limited to regulating zoning and building development. Therefore, these instruments have little leverage on agricultural and forestry land that typically makes up most of the land in uncontrolled and controlled polders (Löschner, 2019).

Unless owners are compensated for the land-use restrictions, it is difficult to regulate cultivation of green areas, designated for retention, and interestingly little research or approaches in practice can be found. Low intensity agricultural land use, such as meadows, is encouraged. Typically, the traditional cultivation is already adapted to flooding but especially controlled polders bring additional limitations. There exist theoretically different approaches to tackling this question: (i) setting incentives or (ii) legally enforcing a certain cultivation. Incentives for a certain use can especially be realized using subsidies. This would be actually rather complex and expensive in its administration and would need a control mechanism as well. Costs might exceed the potential cost in case of a flood event. The second option faces the complexity of public administration and competences. Typically, the decision on the type of cultivation is up to land owners and cannot easily be prescribed. Furthermore, flood management is not closely linked to agricultural aspects in public administration and there are hardly any ways to legally oblige farmers to a specific use (see also Albrecht and Nikolić Popadić, Chapter 3 in this volume). At the same

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

time however, it is possible to link compensation payments to a certain use and exclude others. This sets a clear incentive but might be politically difficult to enforce.

6.2.3.2 Control and restrictions for development

The control and restriction for development in the context of flood retention has two main problems to solve: (i) dealing with existing building stock – especially in uncontrolled polders – and (ii) prohibiting new development that would lead to a risk increase. In the realization of flood management or retention projects, the existing building stock might even sometimes face relocation, such as depicted in examples from Austria (Löschner et al., 2019; see also Löschner and Schindelegger, 2019). This regulatory assignment can be typically addressed by spatial planning instruments such as zoning and development plans.

Firstly however, the actual knowledge about frequently inundated areas leads to the designation of hazard areas via hazard maps that imply land-use restrictions. It is a common practice in many European countries to link the expected severity and frequency of flood events with development and building bans. This is normally included in national/federal water acts that foresee such bans or at least the necessity to apply for special permits within such areas. Even without further consideration in planning instruments, a restriction based on hazard zones can be enforced. Typically, essential uncontrolled as well as controlled polders are disclosed in hazard maps and are linked to binding or at least recommending restrictions for any development.

A challenge in establishing and managing retention areas is the existing building stock. While controlled polders are meant to be flooded more often, which strongly opposes any residential or commercial use, uncontrolled polders might feature existing buildings such as farmhouses, sheds or community infrastructure. Here, the control of the actual internal usage, and any additional construction or reconstruction, is essential.

6.2.3.3 Control of land transfer

This aspect might appear somewhat odd in light of the previous discussion. Any flood protection infrastructure is based on technical projects and therefore land acquisition or the securing of rights of disposal is an essential baseline for a project realization. Land acquisition as preparation for the implementation of a technical project can be based on negotiations, expropriation titles or also pre-emptive rights. The latter enables water authorities responsible for protection infrastructure to acquire full property. Land consolidation schemes can also be applied in such a context as is the case in Germany (Drees and Sünderhauf, 2006). So, there are multiple ways for authorities to acquire land but in some cases public authorities might also consider interfering with land

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

transfer and aim for a long-term buyout instead of paying yearly instalments and compensations in case of events to farmers in retention areas. Here, pre-emptive rights can secure a prior position for authorities to buy land and use it for specific purposes in flood management (riparian vegetation, etc.) or lease it to farmers for cultivation.

Overall, usage restrictions for retention areas are generally harmonized within the planning of technical projects and typically rely on individual agreements and arrangements with land owners. A challenge within this perspective is the consideration of compatible or multifunctional land use. Protection projects do not have the objective or title to include such aspects in their schemes which might lead to diked areas with low-risk agricultural use. One interesting example comes from Israel with the widely known Ariel Sharon Park. The area used to be a landfill and has now been adapted to be a metropolitan park that also serves as a controlled retention basin for the river Yarkon that poses a major threat to essential infrastructure in Tel Aviv (Alon-Mozes, 2012). Nonetheless, it makes a huge difference for development restrictions on what legal land title is established by public authorities. In the case of full buyouts, normally no additional restrictions are needed. Long-term leaseholds and land charges might also enable smooth management. Private land with an increased flooding probability is the target of such regulation. Practice shows that (re)allocating development rights through government-based initiatives with financial compensation is still considered the most feasible approach (e.g. Crabbé and Coppens, 2019).

6.3 DISCUSSION

The presentation of compensation mechanisms and legal restrictions concerning land designated for flood retention purposes clearly shows how closely determining the land use and rights of disposal are linked to economic aspects of valuing land as well as usage rights and thereby to deciding upon compensation. This is an essential linkage as regulation and compensation need to be in line with constitutional requirements, otherwise it would be an actual expropriation (Tarlock and Albrecht, 2016) which occurs in the first place for physical structures but not for land in a retention area. Compensation and usage restrictions differ for land according to its function in flood management. Compensation is typically highest for land needed for technical infrastructure (levee, dike, inlets, outlets – because the alternative uses of that land cease) and in controlled-flood polders, while land that is only affected randomly by rare flood events is rather a target of compensating the actual loss of crops as events are considered to be a force majeure. This mechanism is similar for any legal restrictions enforced on flood-retention areas.

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

Overall, the perspectives of farmers, who mostly supply land for retention purposes, need to be considered. Especially essential here are long-term incentives with simple administration, the particular context of the farmers (cultivation, ecological production, water rights for irrigation) whose livelihoods depend on the land availability and the framing of a joint effort in flood risk management (Holstead et al., 2017). At the same time, there is not much research available that takes a closer look at the role of spatial planning and development restrictions in floodplain management generally and management of retention areas more particularly (Tarlock and Albrecht, 2016).

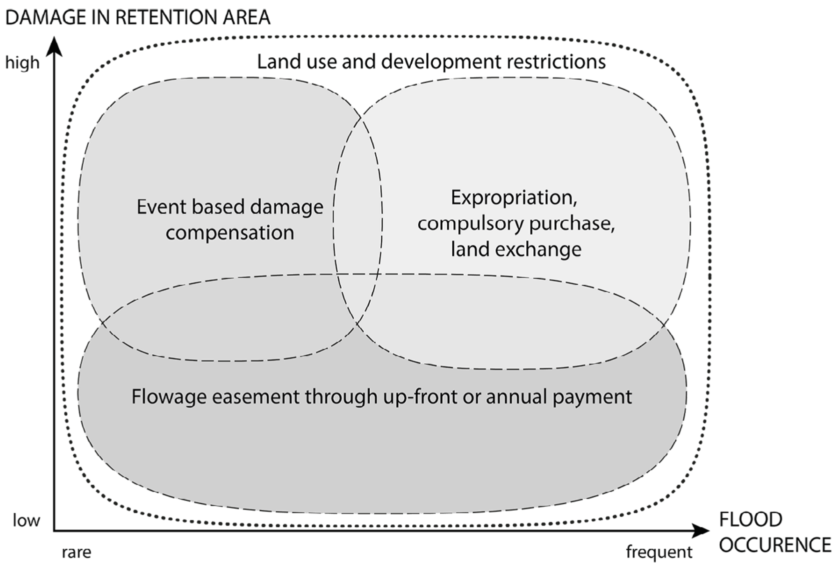

Figure 6.2 Compensation and usage restrictions in relation to flood occurrence and damage potential

Figure 6.2 illustrates the rationale behind different compensation approaches and the linkage to land-use and development restrictions. In fact, compensation for retention services is mostly designed dependent on the likelihood of flood events and the damage expected in retention areas. Especially high damage potential within retention areas (loss of yield) justifies an event-based damage compensation or even a compulsory purchase or similar to simplify the operation of retention areas. In any case, land-use and development restrictions will be enforced. While the formulation of restrictions and conditionalities for land use and development depending on flood hazard maps are common around Europe, retention areas are typically not development zones to safeguard

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

retention services at all times. Land management, though, often struggles to control cultivation in retention areas and this demonstrates that an integrative and comprehensive approach to compensation and land-use and development control in retention areas is an imperative.

ACKNOWLEDGMENT

This research is an outcome of the COST Action No. CA16209 Natural flood retention on private land, LAND4FLOOD (www.land4flood.eu), supported by COST (European Cooperation in Science and Technology, www.cost.eu). Open access of this chapter is funded by LAND4FLOOD.

REFERENCES

Alon-Mozes, T. (2012). Ariel Sharon Park and the emergence of Israel's environmentalism. *Journal of Urban Design*, 17(2), 279–300.

Bos, F. and Zwaneveld, P. (2017). Cost benefit analysis for flood risk management and water governance in the Netherlands. An overview of one century. CPB Background Document. https://www.cpb.nl/sites/default/files/omnidownload/CPB-Backgrounddocument-August2017-Cost-benefit-analysis-for-flood-risk-management-and-water-governance-overview.pdf.

Collentine, D. and Futter, M. N. (2018). Realising the potential of natural water retention measures in catchment flood management: Trade-offs and matching interests. *Journal of Flood Risk Management*, 19(2), 76–84.

Crabbé, A. and Coppens, T. (2019). Swapping development rights in swampy land: Strategic instruments to prevent floodplain development in Flanders. In T. Hartmann, L. Slavíková, and S. McCarthy (eds.), *Nature-Based Flood Risk Management on Private Land: Disciplinary Perspectives on a Multidisciplinary Challenge* (pp. 85–98). Cham: Springer.

Drees, A. and Sünderhauf, R. (2006). Land consolidation as a tool for flood prevention. Conference paper. XXIII FIG Congress, Munich, Germany, 8–13 October.

Dunham, A. (1959). Flood control via the police power. *University of Pennsylvania Law Review*, 107, 1098–1132.

Glavan, M., Cvejić, R., Zupanc, V., Knapič, M., and Pintar, M. (2020). Agricultural production and flood control dry detention reservoirs: Example from Lower Savinja Valley, Slovenia. *Environmental Science & Policy*, 114, 394–402.

Grčman, H. and Zupanc, V. (2018). Compensation for soil degradation after easement of agricultural land for a fixed period. *Geodetski Vestnik*, 62(2), 235–248.

Hartmann, T., Slavíková, L., and McCarthy, S. (eds.) (2019). *Nature-Based Flood Risk Management on Private Land: Disciplinary Perspectives on a Multidisciplinary Challenge*. Cham: Springer.

Holstead, K. L., Kenyon, W., Rouillard, J. J., Hopkins, J., and Galán-Díaz, C. (2017). Natural flood management from the farmer's perspective: Criteria that affect uptake. *Journal of Flood Risk Management*, 10(2), 205–218.

Kiedrzyńska, E., Kiedrzynski, M., and Zalewski, M. (2015). Sustainable floodplain management for flood prevention and water quality improvement. *Natural Hazards*, 76, 955–977.

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

Löschner, L (2019). Commentary: A spatial planning perspective on privately funded natural water retention measures. In T. Hartmann, L. Slavíková, and S. McCarthy (eds.), *Nature-Based Flood Risk Management on Private Land: Disciplinary Perspectives on a Multidisciplinary Challenge* (pp. 77–81). Cham: Springer.

Löschner, L., Nordbeck, R., Schindelegger, A., and Seher, W. (2019). Compensating flood retention on private land in Austria: Towards polycentric governance in flood risk management? *Landscape Architecture Frontiers*, 7(3), 32–45.

Löschner, L. and Schindelegger, A. (2019). *Compensation for Flood Storage*. IWRA Policy Brief Green Series No. 3. https://www.iwra.org/policybriefs/.

McCarthy, S., Viavattene, C., Sheehan, J., and Green, C. (2018). Compensatory approaches and engagement techniques to gain flood storage in England and Wales. *Journal of Flood Risk Management*, 11, 85–94.

Munich Re (2014). *Natural Catastrophes 2013. Analyses, Assessments, Positions*. Topics Geo. Munich: Munich Re.

Nordbeck, R., Steurer, R., and Löschner, L. (2019). The future orientation of Austria's flood policies: From flood control to anticipatory flood risk management. *Journal of Environmental Planning and Management*, 62(11), 1864–1885.

NWRM (2013a). Case study: Seymaz River renaturation, Natural Water Retention Measures. Service contract 07.0330/2013/659147/SER/ENV.C1, European Commission, Brussels. http://nwrm.eu/sites/default/files/case_studies_ressources/cs-ch-01-final_version.pdf.

NWRM (2013b). Case study: Elbe Dyke Relocation (Lenzen), Natural Water Retention Measures. Service contract 07.0330/2013/659147/SER/ENV.C1, European Commission, Brussels. http://nwrm.eu/sites/default/files/case_studies_ressources/cs-de-01-elbe-final_version.pdf.

OECD (2004). *'Indirect Expropriation' and the 'Right to Regulate' in International Investment Law*. OECD Working Papers on International Investment, 2004/04. Paris: OECD Publishing.

Patt, H. and Jüpner, R. (eds.) (2013). *Hochwasser Handbuch: Auswirkungen und Schutz*. Heidelberg: Springer.

Penning-Rowsell, E. C. and Priest, S. J. (2015). Sharing the burden of increasing flood risk: Who pays for flood insurance and flood risk management in the United Kingdom. *Mitigation and Adaptation Strategies for Global Change*, 20, 991–1009.

Posthumus, H., Hewett, C. J. M., Morris, J., and Quinn, P. F. (2008). Agricultural land use and flood risk management: Engaging with stakeholders in North Yorkshire. *Agricultural Water Management*, 95, 787–798.

Raška, P., Stehlíková, M., Rybová, K., and Aubrechtová, T. (2019). Managing flood risk in shrinking cities: Dilemmas for urban development from the Central European perspective. *Water International*, 44, 520–538.

Rauter, M., Schindelegger, A., Fuchs, S., and Thaler, T. (2019). Deconstructing the legal framework for flood protection in Austria: Individual and state responsibilities from a planning perspective. *Water International*, 44(5), 571–587.

REKK (2020). Danube Floodplain Project, WP 4.3: Hungary. Tisza Pilot CBA.

Scottish Executive (2005). *Natural Flood Storage and Extreme Flood Events*. Final Report. Environment Group Research Report 2005/1.

Slavíková, L., Hartmann, T., and Thaler, T. (2020). Financial schemes for resilient flood recovery. *Environmental Hazards*, 19(3), 223–227.

Tarlock, D. and Albrecht, J. (2016). Potential constitutional constraints on the regulation of flood plain development: Three case studies. *Journal of Flood Risk Management*, 13(11), 48–55.

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/

Ungvári, G. and Kis, A. (2018). Közgazdasági döntéstámogatás a Tisza-völgyi árapasztó tározók üzemrendjének kialakításához. Záróanyag – jelentés [Economic decision support feeding the operating protocols of the peak flood storage reservoirs of the Tisza Valley. Final report]. Project document, unpublished.
Van Der Veen, M., Spaans, M., and Janssen-Jansen, L. (2010). Using compensation instruments as a vehicle to improve spatial planning: Challenges and opportunities. *Land Use Policy*, 27(4), 1010–1017.
Weikard, H. P., Kis, A., and Ungvári, G. (2017). A simple compensation mechanism for flood protection services on farmland. *Land Use Policy*, 65, 128–134.

Andras Kis, Arthur Schindelegger, and Vesna Zupanc - 9781800379534
Downloaded from https://www.elgaronline.com/ at 10/16/2025 12:00:40PM
via Open Access. Open
https://creativecommons.org/licenses/by-nc-nd/4.0/